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BRUSH MAKING BY MACHINERY.

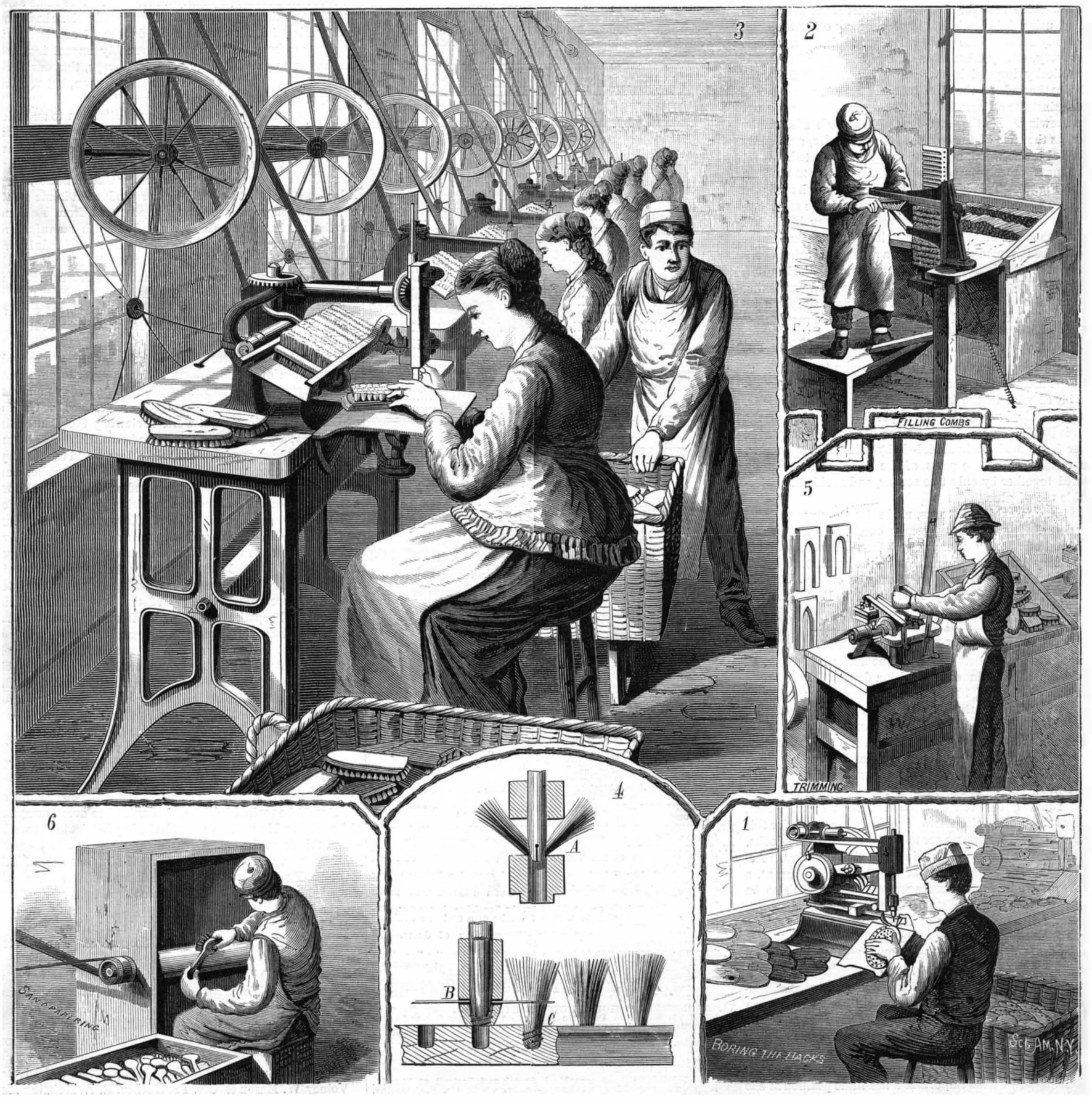
The manufacture of brushes of all kinds, by special machinery, is based on the use of that wonderfully ingenious apparatus known as the Woodbury brush machine. Of this we published a complete illustrated description six years ago, since which time the device has been exhibited at various fairs, and has become widely known. About three years ago it was brought into direct industrial use in the brush factory of the Woodbury Brothers, its inventors, in this city, and it is in this connection that we especially revert to the machine, together with the ingenious appliances by which, at the present time, its work is supplemented.

The engravings, to which we devote our initial page, represent the various processes of brush making, and these we shall describe in due order.

In order to perceive wherein this mode of brush manufacture differs from the ordinary process, it must be remembered that the latter consists in boring a taper or counter bored hole entirely through the block which holds the bristles or hair. The tufts are then drawn or sewn into these holes by means of a wire looped through from the back, and the latter portion is afterwards secured by nails, screws, or glue. Of course if this back comes off the wires are exposed, hence become liable to be broken or corroded, and the brush soon becomes useless. In the present system of manufacture, the blocks which hold the bristles are solid, and no backs are fastened on, the bristles being inserted in holes bored only partially through the wood, and there secured by the action of the machine. Hence the component parts of a scrubbing brush, for example, consist in the solid back, the bristles or similar material, and the binding wire.

The backs are received at the factory already made into proper shape, and the positions of the holes to be made in each block are all marked at once by the action of a stamping press. The backs are then bored, and for this purpose an ingenious little machine, represented in Fig. 1, is used. This consists of a two-spurred bit of suitable size, which is rotated very rapidly and which sinks the holes as fast as the back can be adjusted, the latter being facilitated by a hooked arm, the bent end of which, inserted in a punch mark, draws the back just far enough forward to bring it in position under the bit to have the succeeding aperture made. One machine of this kind easily bores from 50,000 to 60,000 holes per day.

After being bored, the backs are ready for filling, but meanwhile the bristles, by means of the apparatus represented in Fig. 2, are placed between the teeth of the large metal combs, in which they are held ready for the action of the machine. Simply taking a bunch of bristles in his hand, the workman spreads it out, and quickly adjusts it between sidewise projecting bars. A downward pressure on a treadle



BRUSH MAKING BY MACHINERY.

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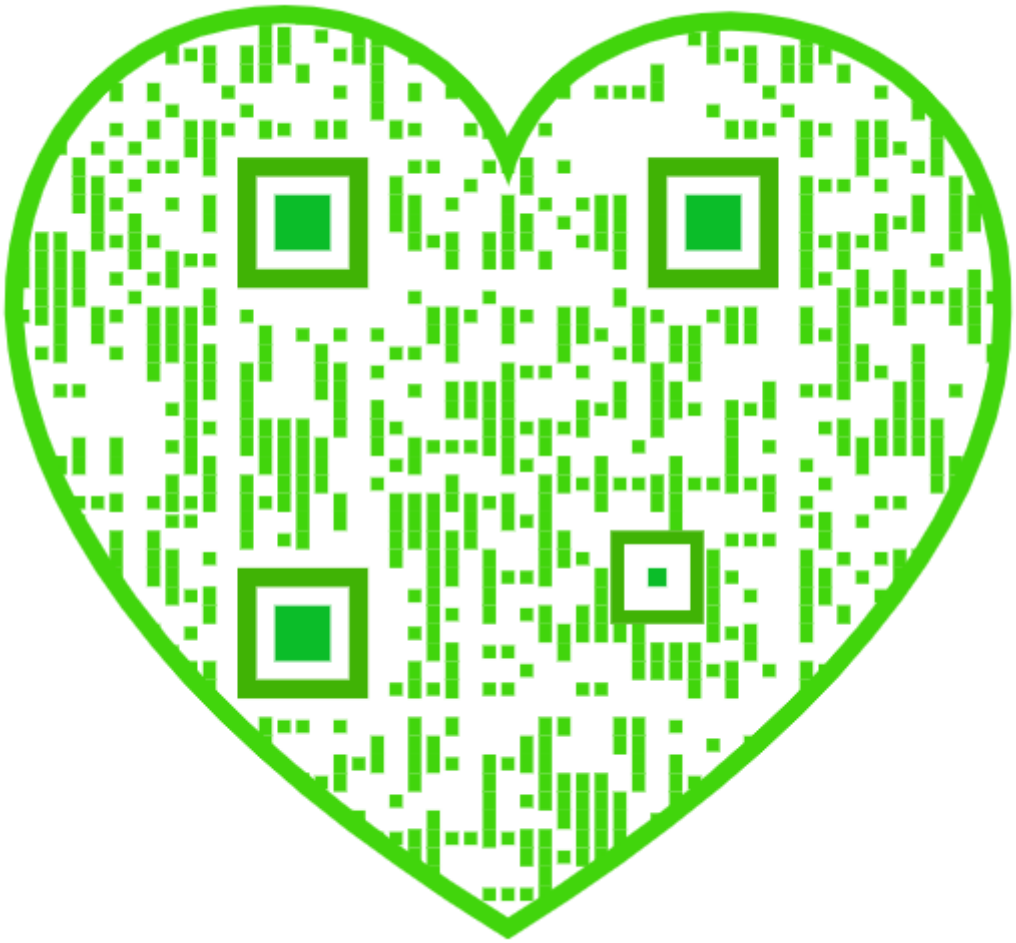

causes the bristles to be caught and drawn in between two teeth of the comb, filling the space. The comb then descends, and another supply of bristles is carried in between the next pair of teeth, and thus the operation progresses until the comb is full.

Brush backs and bristles are now ready to be put together, and here begins the work of the principal machine (Fig. 3), most of the working parts of which are sustained by an overhanging arm upon an adjustable table. The comb filled with bristles being placed in position on guides, and the machine set in operation, the bristles are seized by teeth and forced through a spiral passage way, and so turned that they rest against a guide. A point divides a sufficient quantity to form one bunch or tuft. Below this point is a wedge which moves the bunch to a position directly over a tube and beneath a grooved and slotted plunger, A, Fig. 4, which descends upon the center of the bunch and forces it into the tube, doubling the bristles so that they lie in the grooves of the plunger. At the lower part of this tube is a nut having spiral threads within it. This nut is pierced with holes, and when the doubled bunch of bristles reaches the nut, a wire, moved by automatic feed from a reel, is thrust through the nut and folded in the bristles, and then cut off to the required length.

The plunger tube, nut, and inclosed bristles, B, now descend to the stock or block previously pierced with holes to receive the bunches. The block is sustained by an adjustable plate, and is brought to its proper position by a finder or guide. As soon as the nut reaches the block the plunger turns and twists the wire around the bunch into the spiral grooves, which screw the bunch of bristles through the nut into the holes in the stock, as shown at C. These movements are effected so rapidly that sixty bunches can be inserted in one minute. The movements are entirely automatic.

The machine sets the finest or coarsest stock with equal facility, using bristles, hair, tampico, or any other material, and firmly securing the bunches in wood, leather, rubber, bone, ivory, or any other material used for brush backs. It is practically impossible to remove the bunches from the backs, as the ends of the wire after the same has been coiled abut against the adjacent material, and prevent any attempt at unscrewing. Neither are brushes so made affected by water, as the ends of the bunches, with the wire, are tightly imbedded in the wood, and so thoroughly protected.

The next process is trimming of the bristles to uniform length (Fig. 5). This is done by holding the brush against a revolving cylinder on which curved knife blades are longitudinally disposed. Above is a curved stationary blade, and between the edge of this and the swiftly rotating knives the bunches are trimmed at the rate of a gross of brushes every ten minutes. The last operation is sand papering the handles, as shown in Fig. 6, preparing them for the final varnishing or other finish. The sandpapering machine is simply a revolving cylinder, covered with suitable abrasive material.

There are other contrivances in the factory of the Messrs. Woodbury, designed to facilitate brush making operations or to improve the product, all of which are very ingenious. A neat little contrivance, for example, is provided for inserting a bit of wire in the back of a blacking brush handle. This projection, when the round portion or dabber of the brush is put in place, enters the wood back and prevents the dabber from turning when it is held by a single central screw. This enables the three parts of the brush to be securely fastened together by only two screws, and avoids the objectionable use of glue.

The brushes exhibited to us, made by the processes we have described, were of uniformly excellent quality, fine finish, and of much greater strength than brushes formed in the ordinary way. They are now on the market, and further particulars relative to them may be obtained by addressing Messrs. Woodbury Brothers, 103 East Houston street, New York city.

Prosperity of Barrow, England.

Great extension is being made in the docks at Barrow. A new dock, 200 acres in extent, with a depth of 30 feet and an entrance width of 100 feet, is being constructed, and when finished will be the largest dock in the country. The basin of this dock, 7½ acres in extent, has been completed, and the engineers are now filling it with water by means of a siphon. It will be ready for commerce in two or three months, and so soon as it is opened a new line of steamships, owned by a company formed for the purpose, will commence running between Galveston, Texas, and Barrow, with live stock. Special steamships are being fitted for this trade, and slaughter houses are to be erected near the docks, and the meat will find its way into the dead market. According to the new regulations of the Act of Parliament, a new line of transatlantic passenger steamships will also be inaugurated at an early date between Barrow and North America, under the auspices of the Barrow Steamship Company, which already possesses five 4,000 ton steamships engaged in the Anchor line service. The timber trade, which is largely carried on at Barrow, is to be greatly developed, and the promoters of the new docks have made special provision in this direction. The channel and harbor have been dredged to a great depth, and now operations are going on with a view to the removal of Peel Bar, at the entrance to the harbor, which, when completed, will allow large vessels to enter the harbor even at low water. Barrow is making rapid strides towards as important a maritime position as she holds in manufactures

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NEW YORK, SATURDAY, JUNE 8, 1878.

Contents.

(Illustrated articles are marked with an asterisk.)

American productions abroad... 352
Am. Association, Science 354
Astronomical notes.....361, 362
Barrow, England..... 352
Becquerel, obituary*..... 361
Boiler corrosion.....356, 357
Brazil, trade with..... 354
Brownian movement 354
Bridge, proposed Thames*..... 361
Bronze foundry, Japanese 355
Brush making by machinery*351, 352
Business and personal..... 363
Clock, perpetual 360
Coincidence, is it a?..... 362
Coin tester*..... 355
Communications received 363
Designs 363
Diamonds, African 360
Egg boiler*..... 354
Element, new 354
Fish notes 361
Flour, new process..... 362
Forge, Buffalo*..... 354
Gas motors 356
Inventions, agricultural..... 355
Inventions, mechanical 361, 362
Inventions, new..... 356
Inventors, American 362
Jack, wagon, Smith's*..... 355
Lamp burner, Lungren's* 355, 356
Locomotive, long run..... 362
Meat and beer for Europe..... 358
Moon, remarkable picture..... 357
Notes and queries..... 363
Paris Exhibition building*....358, 359
Patent Office decisions 362
Patents, official list of..... 363
Patent system, Swiss testimony. 357
Petroleum exports..... 357
Pianos, iron frame..... 354
Pulley belts [1] 363
Pump, rotary force* 358
Razor grinding machinery 358
Scientific American Export Ed.. 352
Shaping machine, Manville's.... 358
Sled, Graether's*..... 355
Sounding the South Atlantic 355
Stammering for a purpose 358
St. Gothard tunnel..... 353
Swallows and bed bugs 354
Thirst, effects of 360
Telephone, the carbon* 358
Trade marks..... 363
Tramps, immigrant..... 361
Water electrolysis 358
Welding steel and iron [5]..... 363
Wood, fireproof [4] 363
Workingmen, French 358

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 127,
For the Week ending June 8, 1878.

Price 10 cents. To be had at this office and of all newsdealers.

I. ENGINEERING AND MECHANICS.—H.M.S. Dreadnaught, the most Powerful Ironclad in the World. Comparison between the Dreadnaught and the Devastation. The cul-de-sac dispensed with. Height of Bow, Freeboard, Forecastles. Armor, Machinery, Armament, etc., with one engraving. Trial of competitive Shot against Armor. Important Experiments. Chilled Metal Shot, Gruson's, Krupp's, Finspong, Gregorini, Royal Laboratory Service, an Experimental Kind. Steel Shot, Terre-Noire, Whitworth, Hadfield, Landore, Vicker's, Cammel's Compound Shot. The shot of each maker described and illustrated; How it is Made; Results of Experiments; Descriptions and Engravings of Targets after Trials, and Instructive Comparisons. Ten Figures.—German Patents.—Railway Working Expenses.

Testing the Value of Guns by Firing Under Water. By HENRY A. MOTT, JR. Careful Experiments and their Tabulated Results. The Targets, Cartridges, etc. The U. S., the Springfield, the Spanish, the Austrian Service, and other Rifles. Distances, depth of water, effects on targets, etc. Experiments with cartridges, etc., with seven figures.—Improved White Gunpowder.—Memoranda relating to Condensation.—Experiments on Boilers, with results and Formulæ.—Albert Borseg.—Physical Society, London.—Modern Blasting Explosives. History. Gun Cotton, Nitro-glycerine, Tonite. Chemistry of Explosives.—The Huelva Pier.

New York Rapid Transit Elevated Railways.—New Railway across the Continent.—Beams. Theory of Strength, with formulæ.—Floor Beams.—The Pig Iron Production of the U. S.—Pitches for Screws with Angular Threads. Whitworth's Size, the Old Size, and the New Decimal Standard.

Various Building Materials. Limestones, "Blue-Lias," Roestones, Chemical Reactions in Making Mortar. Portland Cement, Chilmark Stone, Caen Stone. Marbles. Alabaster or Gypsum, Magnesian Limestones, Slates. Their Varieties, Specific Gravities, Chemical Analyses, Durability, Geological Relations, where Found, Uses, and other Practical Information.—New Brick Kiln.

II. TECHNOLOGY.—Photography of the Red.—Metropolitan Stenches.—The Commune Scare.

III. FRENCH INTERNATIONAL EXPOSITION.—M. Giffard's Monster Balloon. Its Size, Construction, Weight, etc., with four figures.

IV. ELECTRICITY, LIGHT, HEAT, ETC.—Recent Remarkable Improvements, applicable to the Telephone. The Measurement of Heat, Sound, etc.

Edison's Carbon Telephone. Successful operation between New York and Philadelphia. Mr. Thomas A. Edison's Improvement in the Telephone, which increases the power of the instrument. Three figures.

The Hughes Telephone. A Marvelously Sensitive Apparatus. Inaudible Sounds Made Audible. The footfalls of a common house-fly heard. Two figures.

Telegraph Experiments.—Crystals.—Transpiration of Gases.—The New System of Numbering Spectacle Lenses.

V. MEDICINE AND HYGIENE.—The Art of Preserving the Eye-sight. No. 2. The Phenomena of Vision. Properties of Light; Absorption, Refraction, and Reflection. Lenses. Chromatic Effects of Cones. Inversion of Image. Adjustment of the Eye to varying Distances. Spherical Aberration. The Eye a Camera Obscura, 15 figures.—Acid of the Gastric Juice.

VI. AGRICULTURE, HORTICULTURE, ETC.—Ergot. By W. CARRUTHERS, F.R.S. A Parasitic Fungus on Rye, Timothy, and other Grasses. Growth, Appearance, and Propagation of the Ergot. Destruction to Cattle caused by it, 4 figures.—The Catalpa. Its Value to Farmers. Cultivation and Propagation.—Belgian Opinions on English Short-Horns. An account of the Investigations of a party of Belgian stock raisers.—Brood Mares and Foals. Ailments and Remedies.—Prospects of the Silk Crop.

VII. CHESS RECORD.—Biographical Sketch and Portrait of Miss M. Rudge, with one of her Problems, and a Game with Mr. F. C. Collins.—Problem by W. A. Shinkman.—Letter Problem.—Chess on the Stage. Dubuque Tourneys Nos. 4 and 5.—Solutions to Problems.

AMERICAN PRODUCTIONS ABROAD.

We directed attention not long ago to the excellent system now carried out by the State Department, whereby our consuls abroad are required to make reports showing the condition of our trade at their several places of residence, and pointing out how the same might perhaps be improved. In connection with what we have already said with regard to the advantages, in the matter of presenting manufactures and inventions, to be gained by representation in the pages of our forthcoming EXPORT EDITION, the notice of manufacturers generally may now be called to some recent special statements of our consuls, as indicating the demand abroad for American productions and the necessity of action to meet the same.

Mr. Alfred E. Lee, Consul General at Frankfort-on-the-Main, says that, "through the reports of European visitors to the Centennial Exposition, our people have established a reputation on this side of the Atlantic as skilled producers, which it is of the highest importance for them to maintain." Frankfort agricultural machine dealers, for example, inform him that American appliances easily outsell those of German make, and among the other articles which manufacturers are counseled to push in that locality are boot and shoe machines, wooden ware, rubber goods, shirtings, prints (there is good chance of successful competition with England in these), watches, lamps, carpenters' tools, paper hangings, and dental instruments.

Our Consul at Nuremberg cites a suggestive instance of a German-American citizen who, residing in this country, recognized a particular form of turbine as just the thing wanted on the small streams of Bavaria, and accordingly he introduced it there with such success that over 400 wheels are now in use. This is but one example of the success which American inventions encounter abroad as soon as their merits become popularly understood. The same correspondent pertinently adds: "After our productions have once had a fair trial, there will be no danger of our losing the foreign markets, and we can reasonably expect increased demand from year to year, provided, always, that our manufacturers do not rest on the laurels already won, but continue to improve in the future as in the past."

Our Consul General at London calls attention to an article in the *Times*, in which it is "distinctly admitted that American manufactures of tools, locomotive engines, and many other kinds of hardware are now obtained in Canada and Australia almost exclusively from the United States, while it is also stated that not only do we produce at home all the manufactured goods we at one time bought from England, but that we have been able to exclude British manufactures from foreign markets." Leading merchants of Leeds inform our consul there that they "have virtually abandoned the hope of ever again seeing their manufactures exported in large quantities to the United States. . . . England has not only lost an important market, but she has met with an active, shrewd, and powerful competitor, which produces as well as manufactures."

The few instances here cited will serve to indicate roughly the condition of foreign demand for our productions, and the success already attained manifestly due thereto and not to the push of manufacturers themselves. Dr. Grothe, of Berlin, in his important work reviewing the Centennial Exposition, says that "there is spread out in America before the eyes of the observing European a new world of industry, with new forms, new methods of work and traffic, new auxiliaries, and under new aspects and conditions." All that now seems needed is the means for bringing a knowledge of this "new world of industry" into the workshops and factories of the Old World, and this means manufacturers have at their disposal in the EXPORT EDITION of the SCIENTIFIC AMERICAN. Each issue of this periodical will contain nearly 100 large quarto pages, embracing most of the plates of the four preceding numbers of the SCIENTIFIC AMERICAN, and will constitute a splendid illustrated monthly exposition of American inventive and manufacturing genius, which cannot fail to exercise a potent influence upon all foreigners interested in the industrial progress of their nations. The numerous fine engravings embodied in the reading columns will be supplemented by the striking illustrations which advertisers can insert at a very reduced cost in the broad pages especially devoted to their announcements, and these may be still further rendered valuable by the addition of carefully prepared descriptive matter setting forth the particular merits and advantages of the different devices. The circulation of the EXPORT EDITION, the first issue of which will be mailed in June, will extend to every commercial center and important manufacturing district in the world—and this from the outset.

Many enterprising firms, realizing the importance of this EXPORT EDITION as a means of introducing their goods abroad, have secured space in its columns. Among these are the following:

Baldwin Locomotive Works, Philadelphia, Pa.

H. R. Worthington, New York, Steam Pumps and Water Meters.

Erie City (Pa.) Iron Works, Portable Steam Engines.

Finch & Co., Waynesboro, Pa., Portable Steam Engines.

Rue Manufacturing Co., Philadelphia, Pa., Injectors.

Chalmers, Spence & Co., New York, Tube Cleaners.

Reading Iron Works, Philadelphia, Pa., Wrought Iron Pipes.

Hoopes & Townsend, Philadelphia, Pa., Nuts and Rivets.

Volney W. Mason & Co., Providence, R. I., Hoisting Machinery.

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Alexander Brothers, Philadelphia, Pa., Leather Belting.
Geiser Manufacturing Co., Waynesboro, Pa., Grain Separators.
Jno. Dickinson, New York, Diamonds for Drills.
J. A. Brown & Co., Providence, R. I., Watch Cases.
Chickering & Co., New York and Boston, Piano Fortes.
L. Postawka & Co., Cambridgeport, Mass., Piano Stools.
Horace Waters & Co., New York, Piano Fortes.
Fairbanks & Co., New York, Weighing Scales.
Marvin Safe & Scale Co., New York.
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Simpson, Hall & Co., New York, Electro Plated Wares.
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J. F. Frueauff, Columbia, Pa., Hydraulic rams.
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Stearns Manuf. Co., Erie, Pa., Circular Saw Mills.
First & Pryibil, New York, Wood Working Machinery.
Bradley & Currier, New York, Doors, Windows, etc.
C. B. Rogers & Co., New York, Wood Working Mach'y.
Stanley Rule and Level Company, New York.
Parker Brothers, Meriden, Conn., Firearms.
Carr & Hobson, New York, Agricultural Implements.
E. Gillet, New York, Ice Machines.
A. M. Lesley, New York, Refrigerators.
B. K. Bliss & Sons, New York, Seedsmen.
Beach, Son & Co., New York, Seedsmen.
W. H. Schieffelin & Co., New York, Druggists.
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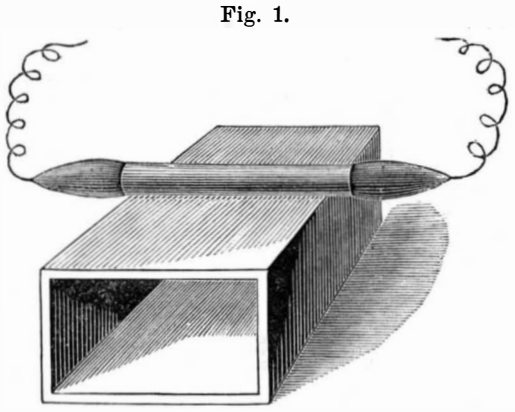
Golding & Co., Boston, Mass., Printing Presses.
Francis & Loutrel, New York, Stationers.
Wilkinson Brothers & Co., New York, Paper-makers.
Photo Engraving Co., New York, Relief Plates.
Macgowan & Slipper, New York, Printers.
J. W. Fiske, New York, Ornamental Iron and Zinc Manfr.
Thompson & Bedford, New York, Lubricating Oils.
W. J. Wilcox & Co., New York, Pure Lard and Oils.

THE CARBON TELEPHONE.

Professor Huxley, on May 9th, read before the Royal Institution a communication received the day previous from Professor Hughes, of Kentucky, the well known inventor of the type printing telegraph, now resident abroad, in which is described, as the original discovery by the author, a new telephone, remarkable for its simplicity and its astonishing power of magnifying and so rendering audible the faintest sounds. Professor Hughes claims to have discovered that certain non-homogeneous conducting substances, placed in circuit with a battery, possess the property of converting sonorous vibrations into undulating currents of electricity, by which not only can articulate speech be transmitted to a distant Bell telephone, but the sound is very greatly magnified. It is well known that when contact is made and broken between a battery and a telephone a loud, dull tick is produced. If, however, the resistance of the circuit or of the battery is suddenly changed a sound is made in the telephone, but it is of different nature. If, for example, the conducting wire is torn asunder, there is heard a grating noise; the same is audible if the wire be bent, and it would appear that this is owing to the fibers, which constitute the wire, beginning to give way or

Fig. 1.



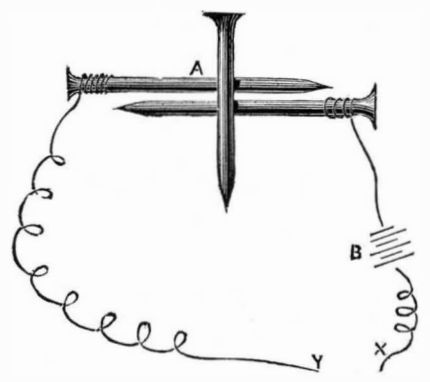
dragging over one another, producing a variation of resistance.

Filling a glass tube with a powder of zinc and tin, Professor Hughes closed the extremities with plugs of gas carbon, which slightly compressed the contents. To these plugs the battery wires were attached, and a galvanometer was placed in circuit. On grasping this tube by the ends, and pulling it so as to subject it to tensile strain, the galvanometer needle was deflected in one direction; on compressing the tube endwise, the needle moved the other way. The particles being separated, in the first instance, and forced together in the second, the resistance of the circuit was varied, increasing the current in the former case, and decreasing it in the latter.

The only disposition of the tube to fit it for the purposes of a telephone was to attach it to the top of a small box which served as a resonator, as shown in Fig. 1. Professor Hughes claims to have found that even a piece of vegetable charcoal impregnated with mercury, or with platinum perchloride, answers nearly as well as the tube, and ordinary mechanical structures which contain a good many joints, such as a small machine or a chain made into a little heap, act almost as well as the substances referred to.

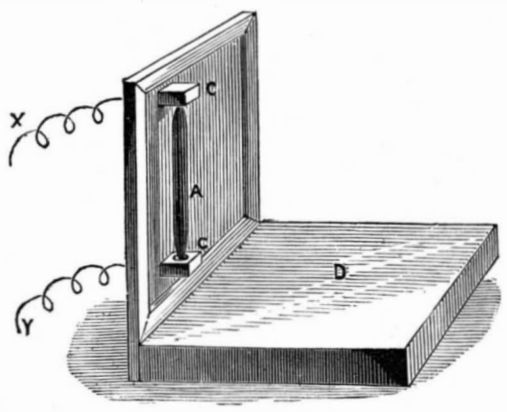
The simplest form of such a structure is shown in Fig. 2, in which two common French nails, A, are fastened down to a horizontal board about a millimeter apart. Wires, X and Y, are attached to them leading to a battery, B, and a telephone, in such a manner that the nails form the only break in the circuit, which can be closed by laying any conducting material across them. When a third French nail is laid across the other two it is clear that (as a cylinder can only touch another cylinder whose axis is not parallel with it in a single point) the electric circuit has a very imperfect connection at the points of contact between the nails, and it is to this faulty connection that the sensitiveness of this arrangement is due. This exceedingly simple device transmits sounds with wonderful distinctness and power. The most sensitive contrivance, however, yet devised by Pro-

Fig. 2.



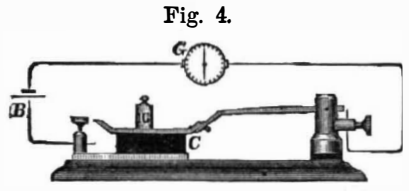
fessor Hughes, is represented in Fig. 3. It consists of a little pencil of gas carbon, A, held in small carbon blocks, C, which are attached to a thin sounding board, secured to a more solid base board, D. The blocks are connected by wires to the battery and line wire leading to the telephone. This little apparatus not only takes up and transmits articulate speech to a distant station with great power and distinctness, but "it detects and converts into loud noises the minutest possible vibrations." Professor Hughes states that "the tip of a soft camel's hair pencil gently stroked along the table on which the instrument is placed is faithfully recorded as a loud rustling sound," and that "the very footfalls of a little common house fly as it walks along the board are heard with unmistakable distinctness by a person whose ear is at the distant telephone, which may be miles away."

Fig. 3.



The discovery on which all this is based seems to us closely similar to that made over a year ago by Edison. He found that, when properly prepared, carbon possesses the remarkable property of changing its resistance with pressure, and that the ratios of these changes, moreover, correspond exactly with the pressure. His device for showing the decrease in resistance is represented in Fig. 4. This consists of a carbon disk, two or three cells of battery, and a galvanometer. The carbon is placed between metal plates, through which and the carbon the current passes. When a given weight is placed upon the upper plate the carbon is subjected to a definite amount of pressure, which is shown by the deflection of the galvanometer needle. The greater the weight, the greater the deflection. Compare this device with Professor Hughes' apparatus for the same purpose, represented in Fig. 5. Here the substance to be tested is placed between the jaws at D, and pressure can be increased or diminished by

Fig. 4.

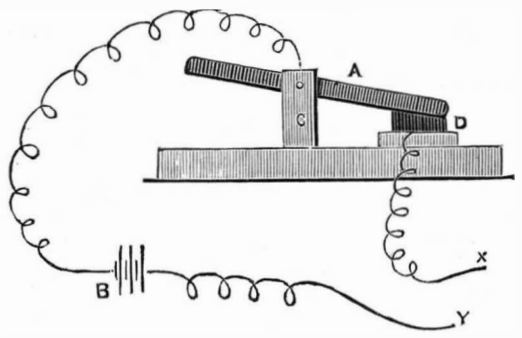


placing small weights on the bar, A, on one side or the other of its pivoted center. The bar is attached through C to the battery, B, and the lower jaw is connected with the telephone and battery by the wires, X and Y. With this instrument Professor Hughes tested powders and various substances in similar manner to Edison, a telephone being used, and the ticking of a clock observed instead of the deflection of a galvanometer needle. It is hardly necessary to point out to the intelligent reader that the two devices are exceedingly alike, and although Professor Hughes in his communication makes reference to Edison's work, he does not seem to have fully apprehended its close bearing upon or possible anticipation of his own. He seems, in fact, to have been oblivious to the various descriptions of Mr. Edison's discovery that have been published here. For example, it would not appear that he had read the description of Mr. Edison's Carbon Telephone, published in the SCIENTIFIC AMERICAN of July 28, 1877.

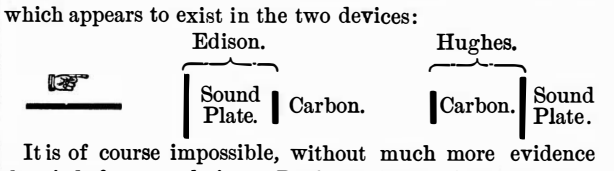
It was of course but a step onward for Mr. Edison to substitute a diaphragm for the weight in his trial apparatus, and to cause the diaphragm to vibrate with varying degrees of pressure against the carbon by the vocal waves. The variations in the current would then cause it to possess all the characteristics of the vocal waves, and by its reaction through the medium of an electro-magnet, might then transfer them to another disk, causing the latter to vibrate, and thus reproduce audible speech.

Edison's telephone, constructed on this principle, is represented in Fig. 6, in which E is the carbon disk, A the diaphragm, and D and G platinum plates which hold the disk, and which are connected in the battery circuit. In a later device Mr. Edison does away with the vibrating diaphragm altogether, and uses simply a rigid plate of metal to "concentrate a considerable portion of the sonorous waves upon the small carbon disk or button."

Fig. 5.

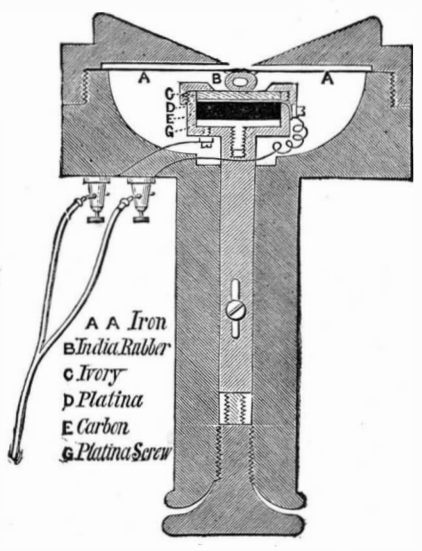


The annexed diagram, in which the hand denotes the direction of the sound waves, will show the small difference which appears to exist in the two devices:



It is of course impossible, without much more evidence than is before us relative to Professor Hughes' experiments, to reach any certain judgment as between him and Mr. Edison, but a *prima facie* case in favor of the priority of the latter seems to us pretty clearly made out. As to the transmission of minute sounds, Mr. Edison some time ago informed us of his having achieved that possibility, which, he said, extended to the registration of minute heat waves. Both inventors, however, are American, both are highly distinguished, and both are equally capable of making so important and creditable a discovery, so that the question we have raised will in no wise, in popular estimation, affect the surpassing value of their work. We are indebted to *Engineering* and to Mr. George B. Prescott's book on the "Telephone" for our engravings. Professor Hughes' communication to the Royal Society, as read by Professor Huxley, will be found in full in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, together with an account of certain practical experiments with some of Mr. Edison's devices.

Fig. 6.



Progress of the Great Tunnel.

A recent report of the inspector of the great St. Gothard tunnel through the Alps states that the irregular character of the formations pierced by the tunnel has entirely ceased, and that the work is now progressing through uniformly regular strata. On the south side the boring progresses at the rate of 10 feet daily through gneiss. The rate is somewhat less on the north side, where the tunnel is not yet out of the serpentine. The thickness of this stratum of serpentine now being pierced is already double that estimated by geologists from the surface indications.

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Invention of the Iron Frame for Pianos.

In our recent paragraph entitled "A Hundred Years' Progress in Piano Making," we ought to have added the interesting fact that the inventor of the iron frame, now used in all pianos, is still living, in vigorous old age, and is still following his original business of piano manufacturing; we allude to Mr. Conrad Meyer, of Philadelphia, Pa. He is now in the 86th year of his age, and is the senior member of the well known firm of Conrad Meyer & Sons, whose instruments have attained a world wide reputation for excellence.

The iron frame was invented by Mr. Meyer in the year 1832, and in the following year, 1833, he exhibited a piano containing this style of frame at the regular exhibition of the Franklin Institute in Philadelphia. This is fully attested by the records of the Institute, by the makers of the instrument, and by the purchaser of this first piano, Mr. John M. Hood, of Philadelphia. After many years of use this piano finally came back into the hands of the original inventor, and was by him exhibited at the late Centennial Exhibition.

Probable Discovery of a New Element.

MM. Marignac and Delafontaine announced some time ago the opinion that gadolinite contained something more as bases than yttria and the oxides of erbium and terbium. Recently M. Soret has found in the ultra violet spectrum of this substance lines which belong to the spectrum of no known metal, and it seems probable that a new element will before long be thus brought to light.

THE BUFFALO FORGE.

We illustrate herewith a new portable forge, the advantages claimed for which are lightness, strength, compactness, a strong blast, and ease in operating the same, the standard aimed at being the old-fashioned bellows in efficiency without the bulk. Another important feature is the facility of operation by means of the swivel handle arrangement below described, in connection with a combination of ratchet and gear. As shown in the illustrations, the ratchet and gear wheel is revolved by means of a long wooden lever, which is made to swing horizontally as well as perpendicularly on the upright arm which projects from the hearth; this lever is connected by an iron rod with a swinging bar, which hangs on the same shaft as the gear, and which holds two pawls. A downward pressure on the wooden handle moves this bar forward, engages the pawls with the ratchet, and causes the wheel to revolve forward; the return stroke releases the pawls. The proportions of the large and small gear wheels and the large and small pulleys being as 1 to 144, and one man, we are informed, being capable of making, easily, 40 strokes per minute, each causing the gear wheel to make from 1½ to 2 revolutions, an idea of speed obtained can be easily formed.

The machinery is all attached to the hearth, and not to the legs, which makes it very compact. The legs are wrought iron pipe, and are screwed firmly into cast iron sockets projecting from the hearth. The working parts being entirely under the hearth, they are not liable to get wet if exposed to the rain or snow when used in the open air. There is no dead center to overcome when starting up, and it is impossible to revolve the fan backward. The journals are all Babbitted. It is not necessary to fill the hearth with fire clay to prevent the working parts from getting hot, but it can be

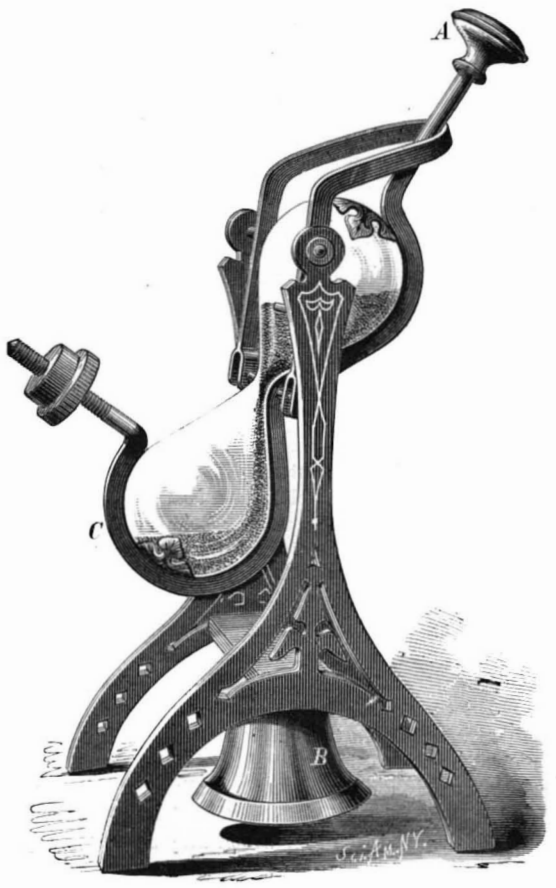
THE BUFFALO FORGE.

done if desired. Each forge has four drop handles attached to the legs, also an oil can shelf. The long wooden handle has an easy motion, which makes the work of operating very light. It also allows the operator to move about his fire on a radius of six feet or more without interrupting the blast. As to its efficiency, the manufacturers state that they have heated a bar of 2¼ inch round iron to a welding heat in 5 minutes. To keep a slow fire it is only required to turn the lid of the ash box, which is attached to the fan case for the purpose of removing the dust and ashes falling through the tuyere, and a sufficient draught is obtained to keep the fire always ready for use during working hours.

For further information address the Buffalo Forge Company, 78 and 80 Washington street, Buffalo, N. Y.

IMPROVED SIGNAL EGG BOILER.

We illustrate herewith an ingenious device for giving an audible signal as soon as the sand in a sand glass has run out, the object being to give warning when eggs are cooked and to save the necessity of watching the glass. The glass is fixed in a wire frame, as shown, and is provided with a horizontal bar or axis, which passes just behind the middle of the glass, and enters bearings in a swinging frame. Upon these bearings the glass and wire frame revolve freely. The swinging frame is suspended between two standards, as shown, and its object is to render the action of the glass more delicate and also equally reliable, whether the surface upon which the pedestal stands is exactly horizontal or not.



The upper part of the frame is bent back and curved to serve as a support for the glass at a suitable inclination. The movement of the swinging frame is limited by stops on the standards. From the bulb of the glass an extension of the wire frame projects, and this terminates in the hammer head, A, for striking the bell or other alarm, B, which is hung between the lower ends of the standards. On the arm, C, which is screw threaded, is placed a nut, which serves to regulate the amount of sand that must run out, and consequently the time that must elapse before the upper end of the sand glass will overbalance the other, and thus cause the glass to invert itself.

The action of the glass is as follows: The bulb containing the sand is turned upward and rests against the frame, as shown. In this position the weight of the hammer head brings the center of gravity of the glass above its center of oscillation, and it is consequently topheavy. When sufficient sand has run into the other bulb to bring the glass into a vertical position, it overbalances and becomes inverted. The hammer then strikes and sounds the bell, and the glass remaining in this position, the sand runs back into the first bulb in readiness for use again.

Patented January 22, 1878. For further particulars relative to purchase of patents for the United States, address the inventor, Mr. Joaquim A. de Macedo, Headingly, Leeds, England.

Trade with Brazil.

The cargo of the pioneer steamship Rio de Janeiro, of the new line to Brazil, was decidedly miscellaneous in character, although its value was not great, only about $170,000. Many manufacturing trades were represented. It comprised printing presses, books, and other printed matter, printers' ink and type, straw paper, cards, cotton drills, wool hats, rice machinery, iron machinery, sewing machines, hardware, axes, iron tubes, pig and bar iron, mule shoes, shoemakers' implements, surgical and dental instruments, surveyors' instruments, boots and shoes, rifles and pistols, clocks and watches, ventilators, wheelbarrows, pump fixtures, belting, copper paint, slate ware, furniture, locomotive engine tender, ivory buttons, drugs and medicines, perfumery, beer, cider, starch, flour, butter, oil, canned meats, lard, and other articles.

Bed Bugs in Swallows' Nests.

During a late trip to the Western territories, Professor Leidy, while watching some cliff swallows passing in and out of their mud built nests, was told that these nests swarmed with bed bugs, and that people would not usually allow the birds to build in such places, because they introduce bed bugs into the houses. He collected a number of the bugs from the swallows' nests as well as from the houses. The latter were found to be the true bed bug; the former, the *Cimex hirundinis*. The bugs infesting the bat and pigeon have likewise been recognized as a peculiar species, with the name of *C. pipistrelli* and *C. columbarius*. The habit of *C. hirundinis* was found to be similar to that of *C. lectularius*, the bed bug, in the fact that the bugs during the day time would secrete themselves in the crevices of the boards, away from the nests. After sunset he had observed the bugs leave their hiding places and make their way to the nests. From these observations it would appear as if the bugs peculiar to these animals (swallows and men) did not reciprocally infest their hosts.

THE BROWNIAN MOVEMENT.

It has been known for many years that minute particles of undoubted inorganic origin were found in the field of the microscope to be endowed with a constant movement, lifelike in its nature. Many early physiologists, such as Buffon, Needham, Gleichen, Müller, Spallangani, and others had doubtless been misled by these dancing particles into a belief that a sort of union existed between the inorganic world. John Bywater was the first to publish a statement respecting this phenomenon in 1819, but Robert Brown made it more widely known, and as his papers attracted considerable attention, the behavior of these particles became known as the "Brownian movement." In recent years little attention has been paid to this subject. Microscopists have continually had the phenomenon under their eyes, and it has been often noticed and referred to as one the solution of which might lead to important results.

When writers on the microscope speak of it they say the particles leap and swarm about with an incessant quivering motion, so rapid as to make it difficult to follow the course of a single particle, which probably changes its direction 15 to 20 times in a second.

Professor Jevons, who has devoted many years of study to this matter, has recently published a paper recording his views respecting the cause of this remarkable motion.

By some it has been attributed to rays of light or heat falling upon the liquid, but this idea has been easily and completely disproved. Dr. Carpenter thought it was due to some calorical change continually taking place in the fluid, or to some obscure chemical action, between the solid particles and the fluids, promoted indirectly by heat. Professor Tyndall quite recently attributed this motion of particles to "surface tension."

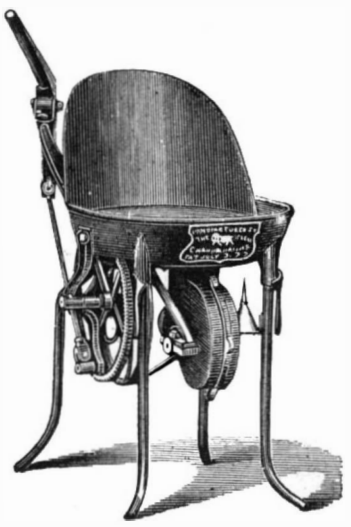
One peculiarity about this motion is its power of continuing without exhausting, for experiments showed that it went on for years, and leaves no doubt that the sediment in many fluids is in perpetual motion, until it finally settles down or attaches itself to the glass.

Almost all substances will show this movement under the proper conditions, but not to the same degree. Professor W. Stanley Jevons, LL.D., M.A., F.R.S., has invented a new name for this movement, and styles it "*pedesis*," from the Greek word πηδησις, leaping, which gives the advantage of the adjective "*pedetic*," from the Greek πηδητις.

To be brief, it may be stated that an extended series of experiments results in the belief that "pedesis" is an electrical phenomenon, and various reasons have been advanced for regarding this conclusion as probable, and as the true solution of this strange movement.

American Association for the Advancement of Science.

The twenty-seventh meeting of the Association will be held at St. Louis, beginning on Wednesday, August 21. The arrangements being made are calculated to render the gathering unusually interesting. Professor Marsh, of New Haven,



THE BUFFALO FORGE.

will preside, and the permanent sub-sections of chemistry and microscopy will be under the chairmanship of Professor Clark, of Cincinnati, and Dr. Blackie, of Nashville, respectively. The annual meeting of the Entomological Club of the Association will be held in St. Louis on the day preceding the general meeting.

DR. G. F. WATERS, of Boston, has found in the juice of the milkweed a remedy for suppurating wounds. The time of healing varied from 24 to 36 hours; but in each instance new skin formed completely across. The Doctor states that the only essential point is to dry the wounded surface gently and thoroughly with blotting paper before applying the milkweed juice. After the juice is applied, and while the healing is in progress, a piece of blotting paper is used to cover the surface.

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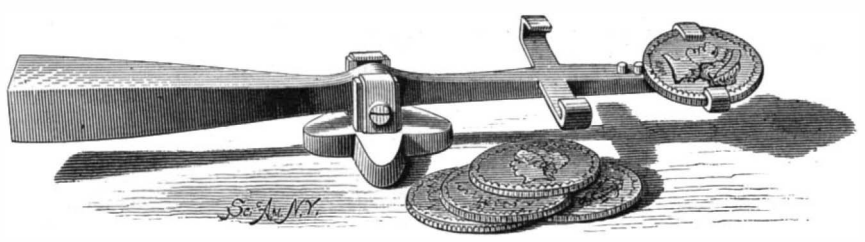
A RELIABLE TEST FOR GOLD AND SILVER COIN.

The steady increase of gold and silver coin coming into circulation has tempted the manufacturers of counterfeit money into active operation, and the amount of spurious metal already in use is very great. The ingenuity of these sharpers is not confined to counterfeiting alone, as they have commenced the practice of another and far more dangerous fraud in the stealing of gold from the genuine coinage now in circulation. This is done by the "sweating" process in the electroplating bath. A double eagle ($20) may, for example, be considerably reduced in weight by this operation. Yet the coin still remains quite perfect in appearance, and none but a practical expert would hesitate to take it. It is hardly necessary to point out the value of a simple, quick, and reliable means of detecting these frauds. The acid test is useless, and as some of the counterfeits are full weight, the ordinary scales are liable to deceive if used as a test. The specific gravity of gold and silver being much greater than that of base metal, a counterfeit must be either lighter in weight or larger in size than the genuine coin, and a scale capable of accurately weighing and measuring the coin is a true and reliable test. Such a scale is herewith illustrated.

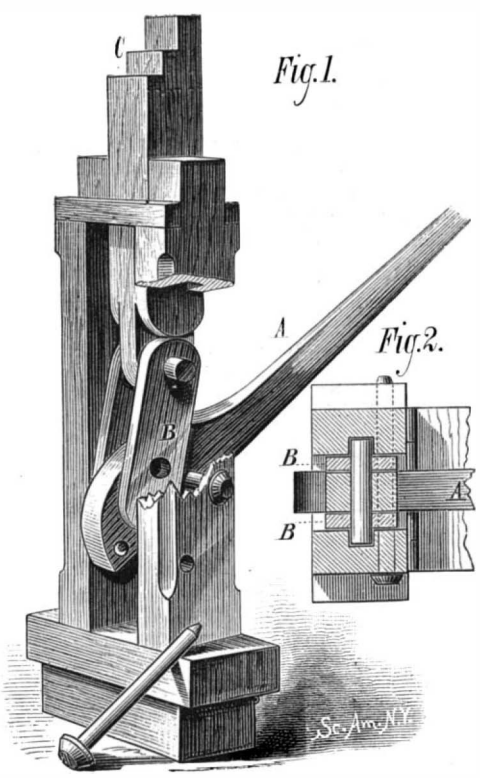
It consists in a balance lever made of hard brass, which works on a knife edged steel pivot similar to an ordinary scale beam. The operating arm of the lever is provided with gauges and adjusting stops, formed and placed in such a manner that by a single movement or application of the coin the three essential tests of weight, diameter, and thickness are made instantly. The gauge has the form of an open slot made just large enough to admit good coin. The size of the coin is tested by the gauge as it enters, and when the coin touches the stop it is tested in weight by the lever. A counterfeit of the proper weight will not enter the gauge. A counterfeit that does enter will not move the lever. The form and position of the stop are of such convenience that it does double duty: holding the coin at a certain point on the lever while being weighed, and affording a remarkably quick and easy means of accurately adjusting the instrument. This adjustment is so fine that the gold test is sensitive to the one fifth part of a grain. The instrument can be made to test any coin or any number of coins, automatically throwing out the good and holding the bad. The apparatus is now in use at the United States Treasury in Washington and at the mint in Philadelphia. The inventor has received written testimonials from the Treasury experts which speak very highly of the reliability and accuracy of the device. It is very neat in appearance, strong and simple in construction, and it cannot get out of order. Patented by P. Doherty, June, 19, 1877. For further information address the patentee, at 621 Fisher street, Philadelphia, or 92 East Tenth street, New York city.



MACHINE FOR TESTING GOLD AND SILVER COIN.

IMPROVED WAGON JACK.

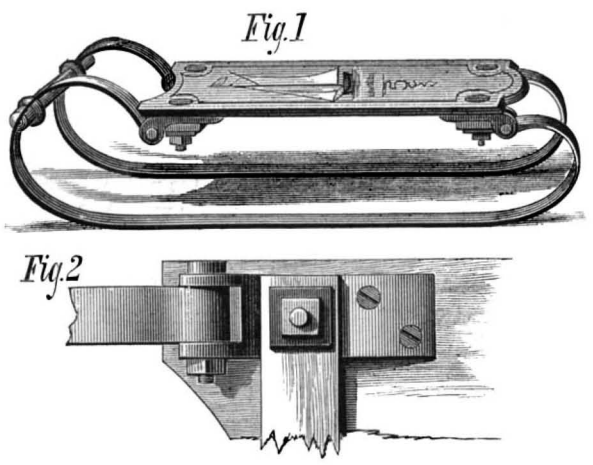
The invention herewith illustrated is a new jack, which may be used for lifting wagons, etc., without change of pin, or to press cheese, hay, apples, etc. Its lever may be of any length, so that no stooping is required in operating it, and it may be easily and quickly adjusted. It consists of the cam lever, A, which is pivoted eccentrically to its fulcrum pin to two links, B, that are again pivoted at their upper ends to a lifting post, C. The latter is guided in the standards by means of interior grooves, into which the pivot pin of the links and post is extended, as shown in the sectional view, Fig. 2, and also by the cross straps of the standard. The upper end of post, C, is step shaped, so as to bear on the axles or other objects. The side standards are provided with a series of holes at both sides, which receive the pivot pin through apertures in the cam lever according to the height to which the same is set for the object to be raised. When the post is elevated to the required height by the lever, it is retained by the post, links, and lever locking each other by coming into line. The object is lowered by swinging the cam lever down. Patented March 19, 1878. For further information address the inventor, Mr. Simeon Smith, Deersville, Harrison county, Ohio.



SMITH'S IMPROVED WAGON JACK.

IMPROVED SLED.

We illustrate herewith a new and simple bob-sled, the improvement in which is found in the runners, which consist of carriage springs attached to the platform by clips, as shown in Fig. 2. The latter are secured by bolts and nuts passing through the crossbars and platform. The arrangement is so plain from the illustration that further description is unnecessary. The device is strong, easily and inexpensively made, and will tend to make the sled run easier. For further information address the inventor, Mr. Theodore Graether, No. 36 Prospect street, Rochester, N. Y.



GRAETHER'S IMPROVED SLED.

A Japanese Bronze Foundry.

A visitor to a leading Japanese bronze foundry describes it as comprising a number of long, low, open sheds, in which everything is in confusion—the artistic, charming disorder of a studio. The products of this foundry are now wholly made by casting, the proprietor not sharing the sentimental enthusiasm of those who prefer archaic methods and crude work to the finer results of improved facilities. Most of the work is done to order. The customer decides on a subject and communicates his wishes to the designer, who makes a sketch on paper and a trial figure in wax. This, as amended and approved by the patron, is completed by the artist as he sits patiently before his brazier, touching the plastic wax with skillful, delicate strokes. The model is then pressed into fine clay, which adapts itself to every line. The metal is then poured in, allowed to cool, the mould is broken and cleaned away, the rough bronze filed and given a luster, and the casting is ready for delivery. Many of the best articles showed the influence of foreign ideas, and were none the worse for it. They comprised vases, braziers, candlesticks, dragons, warriors, lobsters, crabs, frogs, and many other designs. The prices for the nicer ware ranged from thirty to one hundred dollars. Sections of a thousand dollar vase, of tasteful design and exquisite workmanship, were strown about the floor.

Sounding the South Atlantic.

Commander W. S. Schley, of the U. S. steamer Essex, reports to the Secretary of the Navy that he has successfully run a line of soundings from St. Paul de Loando, Africa, to Cape Frio, Brazil, *via* St. Helena, which report is accompanied with the track chart, with soundings marked thereon, and a profile of the ocean bottom.

The greatest depth found between Africa and St. Helena was 3,063 fathoms, or 18,376 feet, and between St. Helena and Brazil the greatest depth was 3,284 fathoms, or 19,704 feet (nearly 3¾ miles). The soundings taken eastward and westward of St. Helena exhibit, in profile, that that island stands almost perpendicular in nearly 12,000 feet of water. After leaving the coast of Africa there is an abrupt descent of 900 fathoms in the first sixty miles from that coast, deepening up to 3,000 fathoms in a distance of about 700 miles, from whence to St. Helena gradual reductions in depth occur, and an entire change in the character of the bottom from mud to coral, rock, and sand.

The soundings were taken by means of pianoforte wire, with the machine originally designed by Sir William Thompson, but improved by Captain Belknap, of the U. S. navy, who first used it in sounding across the Pacific Ocean, in 1873–4.

New Agricultural Inventions.

Mr. S. S. Terwilleger, of Tie Siding, Wyoming Ter., has invented an improved Sulky Scraper for grading roads and for similar uses. The scraper is in one solid piece, and is suspended at the front to the axle by hinged straps and at the rear to a curved lever which holds it in position for carrying or discharging the load.

A detachable Thumb Rest for Sheep Shears, invented by Mr. J. Richardson, Jr., of Pomona, Cal., is intended to afford a good bearing for the thumb, protecting it; and it consists of a concave plate formed on a shank adapted to fit the grasping portion of the shears, to which it is secured by a cord.

Mr. J. Rabenberg, of Breckinridge, Mo., has invented a very complete Incubating Apparatus, for the artificial hatching of the eggs of hens and other fowl. It is a case provided with drawers, in which, on layers of bran, oats, or similar material, to prevent injury and admit air, the eggs are placed. The case has a metallic bottom, beneath which are lamps or stoves, and the direct heat is screened from the eggs by deflectors; while a thermometer, suitably placed, indicates the temperature.

An Artificial Chicken Mother has also been provided by the same inventor, which shelters the newly hatched chicks from the sun, wind, and rain, and furnishes a snug and warm place for them, under which they can retire as under the wings of a mother hen.

Mr. John Wilz, of Santa Cruz, Cal., has made an improvement in Pruning Shears, enabling them to be used conveniently for the removal of branches from the higher parts of trees. The shears are carried at the end of a pole, and the movable blade is worked by a spring and pivoted lever, which latter is operated by a cord and pulley.

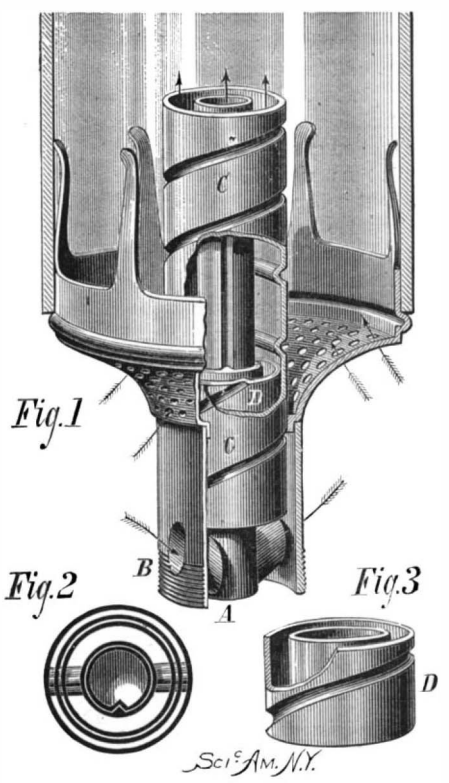
A simple Fence, which may be easily put up and quickly taken apart for transportation, has been invented by Mr. M. S. Zimmerman, of Indian Spring District, Md. The post sections extend only to the ground or to a base piece, and are clamped together near both ends, two pointed drive stakes being forced between the post and lower clamp, and thence into the ground.

Mr. F. M. Meyer, of Shannondale, Mo., has invented a Machine for Setting Tobacco Plants. It is operated by hand, and closely imitates the movements of the latter, pushing the root of the plant into the ground the proper distance and tamping the earth about it.

An improved Hand Scraper, invented by Mr. L. F. A. Legouge, of St. Georges-la-Trétoire, France, is made with a blade having a convex cutting edge, which is notched so as to form teeth, thus forming a convenient weeding tool.

IMPROVED ARGAND LAMP BURNER.

The improved burner herewith illustrated is claimed to be the only one applicable to the common lamp which uses the true cylindrical wick, raised or lowered by a metal carrier in such a manner that the burning edge is always true. The central air tube, A, of the burner, is closed at its lower end, and connected by lateral pipes, B, to the stationary supporting tube which is screwed into the lamp. C is a threaded pipe, to which the chimney supporter and shield are attached, the latter (not shown in the engraving) serving to conduct



LUNGREN'S ARGAND LAMP BURNER.

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air to the exterior of the flame. The wick carrier, D, Fig. 2, page 355, is formed of two concentric shells connected by ribs, and the outer shell, Fig. 3, isspecially grooved, in order that it may fit the projecting thread on the pipe, C. The central air pipe, A, has a groove extending longitudinally along its outer surface, and the inner shell of the wick carrier has a projection which fits in said groove. The carrier is thus prevented from turning when the pipe, C, is rotated to elevate or depress the wick. The direction of the air currents toward the flame is indicated by the arrows.

In applying the cylindrical wick to the burner, the part intended to project below the ribs of the wick carrier is slit to allow of its passage. This does not impede the flow of fluid through the wick or affect the flame. It is claimed that perfect combustion of the fluid is accomplished, and a brilliant white light produced, free from smoke and unpleasant odor. Patented March 26, 1878. For further particulars relative to manufacturing on royalty, address the inventor, Mr. Charles M. Lungren, 708 Lexington street, Baltimore, Md.

GAS MOTORS.

The name of gas engine is now generally applied to any motor wherein a detonating mixture is employed as a source of power. This mixture is commonly composed of air and illuminating gas in proportions varying between extended limits, starting from seven parts air to one of gas, this ratio furnishing the necessary oxygen to consume the combustible elements. The effect of the heat suddenly produced at the moment of inflammation is to expand the gaseous products of combustion, increase their pressure, and render them capable of exerting considerable effort. The temperature after explosion depends upon the composition of the mixture. Gas motors have many points of similarity to steam and hot air engines, as in all the movement is due to the expansion of a gaseous fluid, the essential differences residing in the manner in which heat is communicated to the intermediary agent. While in the steam engine the heat is devoted to the transformation of water into steam in an exterior apparatus, and in the hot air engine the dilatation of air is produced in a furnace independent of the cylinder; in the gas engine the heat is developed within the cylinder itself, and in the midst of the gaseous mass which serves as the motor fluid. The energy is produced at the moment needed, and there is no storing up of heat. Hence it will be seen that the gas engines find a special applicability in cases where continuous work is not required.

Simple as is the principle of the machine, its practical realization is a complex difficulty. The heat developed by the inflammation is rapidly communicated to the air in excess and to the products of combustion, so that instead of a gradual expansion an explosion takes place, the violence of which cannot be reduced by augmentation of the air cushion. Hence the sudden shocks incompatible with the regular and equable motion which the motor should have. In addition to this obstacle is the rapid heating of the cylinder, and consequent radiation of heat which is thus lost.

The first successful gas engines made abroad were those of Hugon in 1858 and Lenoir in 1860. The Otto & Langen machine, subsequently constructed, reduced considerably the expenditure of gas, but it was insupportably noisy, and therefore came into no extended use. Of the most improved gas motors existing abroad at the present time, M. Armengaud gives full details in a paper recently read before the French Société des Ingénieurs Civils. In the Lenoir engine the mixture of gas and air is admitted into the cylinder at atmospheric pressure, which is maintained until the piston has made half its stroke; the admission of a spark determines the explosion. In the new systems of Otto and of Simon, the detonating mixture is compressed first; and exploded by an ignited gas jet when under this pressure. The inflammation is thus gradual, and a progressive explosion is caused. Without going into the details of the separate machines, it will suffice here simply to point out the essential features. In the new Otto engine the piston advancing first draws in the mixture of gas and air. The valve is then shut and the piston returns, compressing the mixture (to about two atmospheres). As soon as the end of the stroke is reached a gas jet ignites the compressed gas, and the piston is thus caused to advance. On the return stroke, the cooled and expanded products of combustion are driven out. An important feature is the arrangement of the valve, so that at first a mixture of 15 parts of air to 1 part of gas is admitted, and afterwards one composed of 7 parts of air to 1 of gas, this causing slow or retarded combustion, the more explosive material being nearest to the gas flame at the moment of ignition. The loss of heat due to radiation in this engine is stated to be but 42 per cent as against 85 per cent in the Lenoir machine, and its efficiency three times as great. The expenditure of gas does not exceed, the inventor says (in high power machines), 23·9 cubic feet per horse power per hour.

The Simon engine, while based on the same principles as the foregoing, is differently constructed. The compression of the mixture is done in a separate cylinder, and the air and gas, after compression, are led to the motor cylinder. There the mixture at once meets an ignited jet, which inflames it. It does not enter the cylinder, however, all at once, but in small quantities, which are successively ignited, thus determining true gradual expansion. The heat developed is small, and a very limited quantity of water prevents overheating of the cylinder. The movement is regular and even. According to M. Simon, the expenditure of gas is 17·6 cubic feet per horse power per hour.

The Bisschop engine belongs to that mixed class which utilize the explosion to cause the ascent of the piston, and atmospheric pressure to determine its descent. The chief advantage of the machine is the mechanical arrangement, which allows of high piston speed. No water is used for cooling, this being effected by radiating surfaces representing five times the exterior surface of the cylinder. Up to the present time only small engines of this type have been built, chiefly suited for running sewing machines. According to M. Armengaud, the cost of operation is 2 cents per hour for the $\frac{1}{16}$ horse power, and 5 cents per hour for the $\frac{1}{8}$ horse power machine.

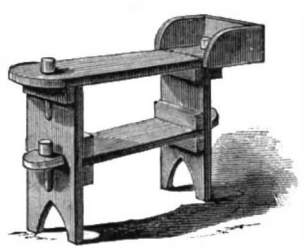
In the Ravel engine, the explosive force of the mixture is employed to move the piston, which is inclosed wholly in the cylinder, motion being taken from the cylinder and not from the piston, a paradoxical arrangement easily understood from the following. In each end of the cylinder is a chamber where explosion takes place, and the cylinder itself is hung on trunnions, which rest in journals, and which, prolonged, carry the pulley from which the power is taken. When the gas is exploded by a flame, the piston is driven to the opposite end of the cylinder. Its weight at the extremity then causes the latter to overbalance, and hence the cylinder rotates on its trunnions; as soon as that end reaches the lowest point of revolution, another explosion sends the piston to the further extremity, and thus the cylinder keeps on rotating. No data of the efficiency of the machine are given, but it is said to be quite economical.

The above constitutes but a brief summary of the more important European improvements made in the gas engine during the last two years. To these may be added a new application of the motor suggested by M. Dupuy de Lôme in impelling balloons. He states that his balloon could be driven at the rate of 13·2 miles per hour if a gas engine of 8 horse power could be contrived, the weight of which should not exceed that of eight men *plus* that of the mechanical device by which their power might be applied to a rotating shaft. The volume of the gas in his balloon is 121,926 cubic feet, the expenditure of which, supposing a portion were used to drive the engine, would be but 282·4 cubic feet per hour, or only about $\frac{1}{431}$ part of the total contents. During his experiment of February 2, 1872, M. de Lôme remained two hours in the air, using a propeller driven by hand. With the engine he might have traveled 26 miles in this period. For flying machines where large volumes are to be avoided, detonating mixtures of oil vapor and air would probably be found better suited as the source of power.

New Inventions.

Mr. Jonathan Miller, of Trenton, N. J., has made several improvements in Apparatus for Making Extracts, such as coffee, tea, etc., pursuant to the method patented by him May 2, 1876, one of which consists in providing a floating cover over the liquid to prevent evaporation, and the others tending to make the mechanical details more convenient.

The accompanying illustration represents a convenient Ironing Table, in which the ironing board proper is hinged and pivoted in such a manner that one end may be raised and turned to one side, for convenience in ironing shirts and similar garments. A hinged tray or extension is pivoted to the frame, serving to hold the water cup, sponge, hot irons, etc., and since it remains horizontal, whatever the position of the ironing board proper, there is no danger of such articles being overturned. Patented April 16, 1878, by Mrs. Emily A. Hill, of Princeton, Ind.



An ingenious Revenue Registering Device, the invention of Mr. S. J. Tucker, of Richmond, Va., is one of the results of the new liquor law of that State. It is intended for registering alcoholic drinks, but is applicable to other counting purposes. The mechanism for causing a full movement of the numbered disks and preventing them from being turned backward is complete, and in addition to the usual bell, a polygonal roller having faces of different colors is made to rotate so as to exhibit a new face through the outer case each time the revenue account is increased.

Mr. Wm. Riker, of Newark, N. J., has invented an improved Process of making Finger Rings, by which with few manipulations he is enabled to produce a solid gold ring having inlaid designs of different colors of gold, while its groundwork, edges, and internal periphery are of uniform color and quality.

An improvement in Boot Uppers has been patented by Messrs. S. W. Allen and Isaac Cook, of Tonica, Ill. The object is to furnish boots which will not wrinkle or shrink, which will enable the leather to be cut with less waste, and which will not need to be crimped. The forward part of the leg is made in two pieces, seamed to each other at their forward edges, and seamed at their lower ends with a lap seam to the vamps.

Mr. F. Feike, of Middletown, Mo., has invented an improved Fence, to be used in the beds of streams and rivers, which is claimed to resist the action of floods, and which may be cheaply and easily constructed. It consists of a number of slats or bars supported by suitable framework so as to present an upwardly inclined surface to the current.

In a new device for Fastening Bottle Stoppers, patented by Mr. G. F. Outten, of Norfolk, Va., the stopper is stiffly fastened to a sliding bail, and the lower end of the latter is connected with a stationary collar about the neck of the bottle by a pair of toggle arms, whose middle joint is thrown in, to lock the stopper down, or out to allow the bail to be slid up to disengage the stopper, a lever latch being employed to throw the toggle out, and a guide link being employed in connection with the bail to cause the latter to move to its proper position when the stopper is removed.

An improvement in Cigar Moulds, made by Mr. G. W. Hamilton, of Fredericksburg, Va., consists in casting the matrices in two parts, and in holding them together upon the bed plate by means of elastic blocks, which allow them to yield slightly when the dies descend. The invention further relates to the use of a temporary binder for wrapping the tobacco and for lining the moulds, and preventing contact of the tobacco therewith. The ends of the matrices have flanges for the purpose of securing them to the bedplate.

Mr. W. Parkin, of Taunton, Mass., has patented a convenient Beverage Holder, for ice water, coffee, tea, etc., which is adapted for use on family dining tables or in restaurants. It is a vessel of cylindrical form and ornamental appearance, provided with a pump, and also having a lining or inner cylinder, between which and the shell of the holder is a dead air space to prevent the conduction of heat.

A simple Self-Lighting and Extinguishing Lamp, invented by Mrs. E. G. Haller, of Philadelphia, Pa., is constructed upon the general principle of utilizing a self regulating hydrogen gas generating apparatus provided with a stopcock and vent tube, arranged in the burner so that the flame from the vent tube serves when ignited to ignite the wick. The ignition is effected by the peculiar property of "spongy" platinum, and the apparatus is so simplified as to be convenient in use.

Mr. Z. N. Morrell, of Luling, Tex., has devised a portable Fire Proof Lint Receiver for the lint discharged from cotton gins. This lint is so combustible as to cause frequent accidents. The receiver is rectangular, constructed of sheet iron, and provided with doors, one of which is adapted to close automatically when the receiver is removed away from the gin. The body of the receiver rests upon a wheeled platform, to which it is secured by iron bars or rods passing through brackets affixed to the top of the receiver, so that they will support the top and prevent collapse of the receiver, in case it becomes red hot from ignition of the lint.

An improved Curry Comb, recently patented by Mr. L. A. Griswold, of Marshfield, Ohio, is made double, and is so constructed that the combs may be exchanged, thus forming four curry combs in one.

Mr. T. C. Thompson, of Evanston, Ill., has invented an improved Gaff for Vessels, which is provided with an end socket having locking devices to secure the gaff to the boom when lowered, thus preventing chafing of the sail.

In a new Pen, patented by Mr. W. M. Prince, of Pittsfield, Mass., there are two distinct nibs, which are so arranged that the same amount of pressure upon both nibs will produce a heavy and a light line, for convenience in ruling.

Mr. J. Homrighous, of Royalton, Ohio, has invented an improved Burial Casket, which is capable of being adjusted with facility to the required length. It is made in two parts, of which the foot section, being smaller than the other, is adjustable to a certain length in the head section, and the parts are connected by side and bottom screws.

A Coin Pocket Book, patented by Mr. A. L. Thurston, of West Salem, Wis., is formed with a flat frame, having recesses corresponding to the different denominations, and spring-cushioned caps moving in the recesses and working in connection with catches, which retain the coins at one side, but allow them to be slipped out easily at the other.

BOILER CORROSION.

There is an evil which is very often confounded with, or improperly considered in connection with, the formation of scale or crust in boilers. This evil, perhaps of equal magnitude, but proceeding from entirely different causes, is corrosion.

As it very frequently attacks the external surface of boiler plates, it can readily be seen that it is not always inseparably connected with impure feed water, and as it is perhaps most marked in conjunction with the use of so-called "pure natural waters" (that is, those leaving no solid residue on evaporation and having no action on test paper), it will be seen that to rush blindly into the use of such "pure" waters as a remedy for incrustation is not always safe.

Careless setting in too much lime (perhaps impure lime) often badly corrodes the plates of land boilers externally. This trouble calls for very simple prevention. Where the foundations are too damp and undrained, moisture sometimes reaches the plates through the lime or through the ashes. As ashes frequently contain strong alkaline salts, they can by long cold contact, if moist, badly corrode the plates.

It is known that when wood or soft coal is imperfectly burned, there is a distillation of pyroligneous acid; and by injudicious use of wood in starting fires, or by too heavy charging of coal, such distillation may take place, the soot in the flues and tubes becoming so impregnated with acid as to attack the metal. Even the fine dust of ashes, containing sulphuric acid derived from the pyrites in the coal, may produce the same effect.

Where brass cocks or connections are bolted to or screwed

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into the boiler shell, there is often corrosion caused by galvanic action, there being the essentials of a galvanic series—an attacking fluid, and two metals unequally attacked by a fluid. This action is intensified by the heat, and by any leak which may exist.

All these troubles exist on the outside—that is, the "fire" side of the boiler. Inside, the influences are more complicated, mysterious, and serious; but reason and experiment will baffle them.

Now sea water corrodes iron and steel plates quite rapidly, dissolving in a month 105·31 grammes of steel from a plate 40 centimeters square; and in the same time 99·30 grammes from an iron plate of the same size. Iron kept in water containing carbonic acid gas oxidizes rapidly with escape of hydrogen gas, proving the decomposition of the water, apparently by galvanic action, or rather by what is called catalysis, where one element, not itself attacking another, causes a third to do so. Dry oxygen does not corrode bright steel or iron; damp oxygen slightly corrodes them. Dry carbonic acid has no action thereon; damp carbonic acid forms a white carbonate of iron on them. Dry carbonic acid and oxygen have no effect, while damp carbonic acid and oxygen have a very rapid oxidizing action.*

Distilled water, free from air or gases, does not corrode iron, it being very difficult to get a bright blade immersed therein to do much more than slightly spot with rust; and careful examination of these spots generally shows at each point an impurity in the iron sufficient to induce a galvanic current, just as a piece of zinc or copper placed against the iron would do. Trying lead plates, it is found that while distilled water free from air eats off in two weeks, from a square meter of surface, only 1·829 gramme, the same quantity of the same water aerated dissolved away 110·003 grammes.†

The presence of chlorides of magnesium, ammonium, sodium, potassium, barium, and calcium dissolved in water largely increases its rusting action on iron. The magnesium chloride is the most active of any one of these; but in conjunction with lime carbonate is also active; as are mixtures of the calcium chloride with that of sodium or of barium.

The chloride of magnesia solution is of all these, however, about the only one that attacks iron at 212° Fah. when there is no air present.

Considerable trouble is often caused where the injection condenser is used, and the condensed water contains slight quantities of lime and magnesia salts, which, at say 150° Fah., form soaps with the grease brought over from the cylinders, etc. At higher heats these soaps decompose into free fat acid (generally oleic), and a basic lime soap, which at still higher temperatures may be carbonized. The soap adheres to the boiler surfaces, and the acid attacks the iron, which darkens the scale.

Even if there be no salts brought over, the destructive distillation of fatty matters is, while giving no scale, none the less injurious and destructive than in the case last cited.

Where the water contains lime and magnesia salts and fat acids, the remedy is lime water and caustic soda, which remove both the fat acids and the magnesia.

There are so many cases where boilers fed with "pure natural water" have been rapidly corroded away, that steam users congratulating themselves that they are free from the evils of scale should see if they are not using pure water containing gas in solution, and if there be this trouble, it may be cured by a regular dose of whitewash, or by mixing calcareous water with the soft gas-holding water.

When pure distilled water is used there will be no contained gas and should be little trouble from corrosion. Perhaps for marine purposes it will be impossible to escape corrosion without employing copper boilers, and even then we are not so sure about it.

SWISS TESTIMONY TO THE ADVANTAGES OF OUR PATENT SYSTEM.

Hitherto anti-patent men have found their strongest argument against the recognition of any property right in inventions in the practice of Switzerland. "Here," they have said, "we see the benefits of free trade in ideas. Switzerland wisely refuses to allow her industries to be taxed and overridden by patent monopolists. See how prosperous she is—how successful her manufactories—how skillful her artisans! Be wise and profit by her example."

At first thought, nothing would seem more reasonable than to suppose that a manufacturing country which should reserve to itself the right to appropriate the inventions of all nations without payment of inventors' fees would be so much in pocket, at least. But the experience of Switzerland, where the experiment has been tried under the most favorable conditions possible, does not make the supposition good. On the contrary it has proved decidedly a losing game; and the loss has fallen where it could least be afforded—on the industrial character and productive capacity of her artisans. The Swiss workman has dropped behind in the contest for mastery, and Switzerland's trade is departing in consequence.

Take, for example, the shoe trade. The largest shoe factory in Europe is at Shoenwerth, between Bâle and Zurich. It was set up for its owner, Mr. Bally (one of the Swiss Commissioners to the Philadelphia Exhibition), by American mechanics; and it is stocked with the best American machinery. Mr. Bally is a man of exceptional force and business ability. He has visited this country often, and is familiar with American methods of organizing labor. He is careful to secure promptly every new invention bearing on his business. He has no royalties to pay; and he pays his workmen less than American rates. Yet he cannot compete with New England, even in Swiss markets. He has lately recounted his experience in this connection in a pamphlet addressed to Swiss manufacturers; and he traces the inability of his workmen to compete with Americans to their inferior intelligence and skill, an inferiority mainly due, he is quite sure, to the lack of the stimulus of a patent system. He tells his countrymen very frankly that their industries are seriously overshadowed by those of America, and that their industrial salvation must be looked for, largely, if not mainly, in a patent system approximating ours. He says: "We must introduce the patent system. All our production is more or less a simple copy. The inventor has no profit to expect from his invention, no matter how useful it may be. On the contrary, each one has the right with us to appropriate to himself an invention, to copy it, to the great injury of the inventor. It is evident that this absolute want of protection will never awaken in a people the spirit of invention, but on the contrary it accustoms them more and more to copy that which belongs to their neighbors, and that is not to the honor of our country. The want of protection for new inventions is a great disadvantage to us. The State ought not to hesitate to add to its resources this new resource. But at the same time we must remember that an invention is valuable in proportion to the facility with which it can be made available, and so it is essential that the grant of patents be accessible to inventors of the most moderate fortunes."

In an appendix to a French edition of this pamphlet, Mr. Edward Dubied, from the standpoint of the watch manufacturer, quite as strenuously insists on the immediate adoption of a good patent law. After reviewing several lines of production in which American competition has brought things to a desperate pass in Switzerland, he says:

"At this rate, there is no reason why all our industries should not be overwhelmed, one after another, by those of America; and yet, when we ask what wages are paid the workmen in the latter country, we learn with surprise that they are three times as much as those which our workmen, both artisans and farm hands, receive. The conclusion from these facts is that our intelligence and productive power, compared with those of America, are as one to four—a proportion which we must admit, if it is true that an American factory which pays its workmen three times as much as a Swiss factory, and has to give a much higher rate of interest for its capital, nevertheless can produce at less cost."

Two things are requisite, Mr. Dubied goes on to say, to get them out of the plight they are in. First, a good patent law; and second, an increase of the technical instruction of their artisans, foremen, and masters. He says: "Our readers are perhaps astonished that we insist upon a patent system as of the first necessity; but we shall justify this by proving that the protection of property in inventions develops the desire for technical instruction, while the absence of such legal protection is nothing more or less than a premium given to ignorance, to the detriment of inventive talent." Further on, he points out the secret of the educative influence of patent rights by showing that in patent granting countries intelligence, technical instruction, and inventive intellect have a real value.

Mr. Dubied's testimony is so strong and so much to the point, withal so pertinent to the discussion in progress here, that we cannot refrain from quoting his final words in this connection: "Messrs. Favreperret, Bally, and David, our Commissioners to the Philadelphia Exhibition," he says, "call for a patent law in Switzerland as a means for perfecting our industries. The author of these lines regards the institution of patents as the first and indispensable measure, without which any other will be utterly useless, for reaching the end that we all have in view. If he especially insists upon this point it is because he had the advantage over the gentlemen he has named, of spending twenty-five years as engineer and machine builder in a patent granting country—namely, France—before he established himself as a manufacturer in Switzerland. He can, therefore, bring his own experience to the support of their demand; and he assures his fellow citizens that a law for the protection of property in inventions would be a true magician's wand among us, completely transforming our system of manufactures, and raising us in a short time, in a natural manner, and with less effort than we should expect, to a level with the nations most advanced in the arts. . . . Away with those false principles which conduct an industry to certain ruin. Let us delay not a moment to obtain a good patent law."

We would respectfully commend these expressions of dearly bought wisdom to those gentlemen at Washington who are dallying with "those false principles which conduct an industry to certain ruin." The most enlightened minds of the most enlightened countries are convinced that the prime secret of American superiority in the industrial arts is due to a patent system, the inspiring, educating, and encouraging influence of which reaches every grade of society. Thus far it has been conducted with a view solely to the advancement of the arts through the encouragement of inventors. To "amend" it, as now proposed, so as to make the inventor the cat's paw of the infringer would be to cut the very heart out of the system, and put a summary check to our industrial progress.

* The reader will see that the influence of dampness, etc., in air is of importance as regards the corrosion of parts of iron railway bridges, and other similar structures, especially where not well painted.

† It will be seen that this has a bearing upon the water pipe question, but we will not discuss that now.

A REMARKABLE PICTURE OF THE MOON.

There are perhaps few persons who, in passing up and down Broadway during the last few weeks, have not had their attention attracted to a remarkable and strikingly brilliant picture of the crescent moon exhibited in the show window of Messrs. Scribner, Armstrong & Co.'s book store. It was a happy thought that led Mr. Henry Harrison to attempt this painting, and the success that has crowned his efforts affords a most excellent example of the results that one may attain in such matters, when to the skill required for manipulation is joined an absorbing love for the object of representation as a subject of study. For it must be stated that Mr. Harrison is an astronomer; and while he has displayed in his painting all the sentiment and all the technical skill of the artist, that "high art" feeling which prompts the belief that "it is not the mission of art to represent nature, but only to use her as a means to express an ideal," he has subordinated to scientific accuracy; and herein lies the great interest and great value of his work. So, with a knowledge of the artist's motives and of the means that he employed to secure accuracy in the measurement of distances, and in the colors and contours of the objects presented in the lunar landscape, we can scarcely be impressed by any other feeling in looking at this canvas than that we are gazing, not at a mere picture, but at a reality—at the wildly desolate surface of the satellite as she might appear to us could she be brought within range of our unaided vision.

The canvas is unpretentious in size, being only 27x27 inches; the painting represents the moon about three and a half days old—*i. e.* "in her crescent"—with the terminator at Mt. Glacier, the edge toward the sun bathed in most brilliant sunlight, shading off into a light yellowish tinge, and then blending into the darkness of night toward the terminator. In the earthshine, or surface in shadow, may be seen some of the most prominent features, such as the craters *Copernicus* and *Tycho*, the *Apennine Mountains*, and nearly all of the *Meres*. The whole orb stands out in bold relief, against a dark sky blue background, the exact color of the field of the telescope an hour after sunset.

The moon has been a subject of topographical and pictorial representation by astronomers for ages past. Its entire surface has been surveyed and mapped in outline, more or less accurately, by Lohrmann, Herelius, Baer and Maedler, and Schmidt; drawings of single craters and casts of the whole planet have been executed by others, and the development of the photographic art has been the means of production, by Messrs. Rutherfurd and Draper, of lunar pictures nearly absolutely correct.

Yet, if we except some small water color sketches of some of the more prominent mountains and craters, reproduced in print to illustrate Neison's work on "The Moon," and a few others by the Astronomical Society in London, we believe that Mr. Harrison's is the first attempt to render a faithful picture in colors of the moon as it appears to us in the telescope, showing its delicate gradations of light and shade, its enormous circular caverns or pits strewn with bowlders, its level plains, its brilliantly illuminated towering peaks and crater walls, its ever varying terminator, and, above all, that lustrous sheen that is all its own, and that has made it recognized as the "silvery" planet. It is Mr. Harrison's intention to publish, in oil color chromos, a series of six *facsimile* reproductions of paintings of the moon in its progressive phases from the "three days' old crescent" (just noticed) to the "full moon" and "last quarter." We see no reason why (if the reproductions come up to the standard of excellence shown in the original) the venture should not prove a perfect success, through generous aid accorded him by all who are interested in the advancement of science and art.

American Petroleum Exports.

The exports this year have been larger than for any year previous to 1877, the total exports in gallons from January 1 to May 11 having been for five years:

1878.	1877.	1876.	1875.	1874.
76,623,252	87,252,268	72,024,491	60,542,620	71,176,609

Before 1874 the exports had never reached 60,000,000 for this period.

The distribution of the exports from the different ports is a matter of considerable interest, as it is now supposed to be substantially regulated by the contract of the Standard Oil Company with the railroad companies. Last year, it will be remembered, the proportion exported from New York increased enormously, largely at the expense of Philadelphia. This was chiefly due to a contest between the Standard Oil Company and the Pennsylvania Railroad, by which the former, controlling most of the petroleum to be shipped, refused to send anything over that railroad. That conflict broke out just about a year ago and lasted six months. Thus the part of the years for which the above figures are given was uninfluenced by this contest. New York exported 71·3 per cent of the total both years; Philadelphia, 15·2 per cent last year and 13·8 per cent this; Baltimore 9·8 per cent last year and 13·4 per cent this. New York has never, or at least not for several years, exported a larger proportion than this year; Philadelphia, on the other hand, has never exported a smaller proportion (28 per cent in 1876 and 17·2 in 1875); Baltimore, in spite of its increase, has not this year reached the proportion which it reached in 1876 (16·7 per cent). So far this year the reports show that 71·3 per cent of the whole has gone by way of New York, 13·9 by Philadelphia, 13·4 by Baltimore, and 1·4 by Boston.

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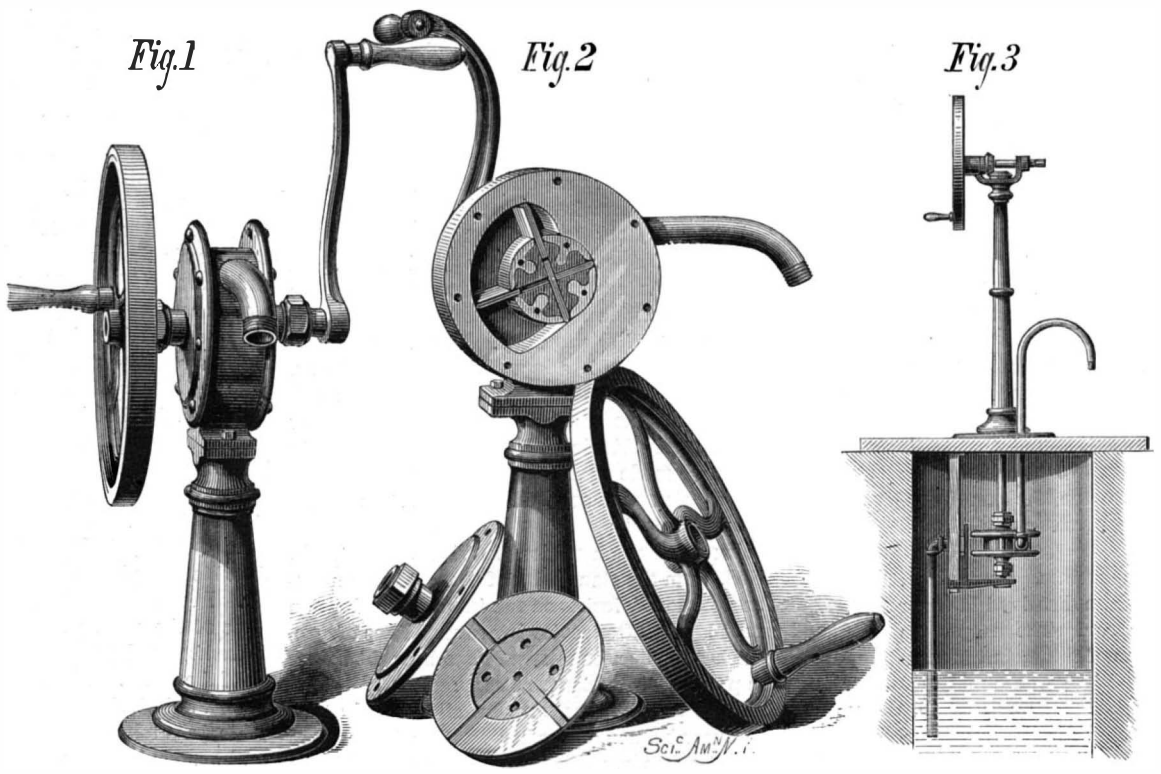
IMPROVED ROTARY FORCE PUMP.

The accompanying engravings represent a new rotary force pump, which is simple in construction, having each part so adjusted as to combine ease of operation with durability and power. It is manufactured entirely of metal, thus being available for pumping hot or cold fluids, and for use in distilleries, breweries, factories, etc., while, for ordinary family use, it may be applied to the forcing of water to any desired elevation. As the pump is essentially a force pump, from the power generated in its use, it offers a cheap system of fire protection in villages and cities having no regular system of water works. It is claimed to be capable of throwing a steady stream of water, from 60 to 80 feet, with ease. Its availability as a lawn and garden pump will be evident.

Figs. 1 and 2, in the engraving, show a small sized indoor pump for kitchen, shop, or factory use; it has a one inch discharge pipe, and is capable of raising from twenty to thirty gallons per minute. Fig. 2 has the same capacity, but is arranged so as to be placed below the ground a sufficient distance to insure safety against injury or inconvenience from frost. It is operated by means of bevel gearing at the top of the iron standard. The details of interior construction are clearly exhibited in the engravings.

For further particulars address Messrs. D. E. Saltonstall & Co., Toledo, Ohio. Patented by Alonzo Noteman, January 29, 1878.



NOTEMAN'S IMPROVED ROTARY FORCE PUMP.

Meat and Beer for Europe.

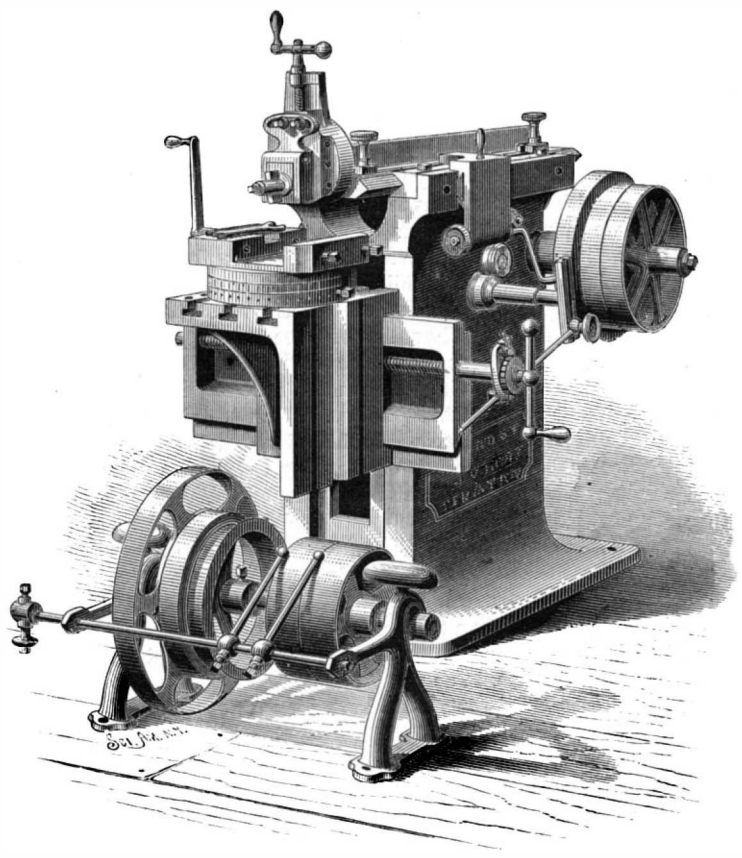
American beer for Germany is the latest addition to our export trade. The exportation of meat shows the same upward tendency manifested by all other American products sold on a large scale for European consumption. The quantity of American meat landed at Liverpool the third week in April was the largest up to that time, and the individual consignments in many cases exceeded any previous ones. The total receipts for the week were 9,686 quarters of beef, 3,004 carcasses of mutton, 400 hogs, 450 live oxen, and 40 horses.

IMPROVED GEARED FRICTION SHAPER.

The illustration herewith presented represents an improved geared friction shaper, manufactured by the Hendey Machine Company, Wolcottville, Conn. It embodies many new principles which are of considerable merit. Change of motion is accomplished by means of a friction clutch, which is both prompt and powerful in its action. Motion is obtained by means of open and crossed belts running upon loose pulleys on the driving or first pinion shaft, a train of gearing being employed to drive the head bar. By the use of the shifter dogs on the head bar, the length of stroke (24 inches) may be varied without stopping the machine, thus rendering adjustment easy and rapid.

Between the journal bearing of the shaft and the inner pulley is a collar having a short spiral slot. By means of the shifter dogs and a rod connected to the collar, it receives a slight oscillating motion, which is changed to a longitudinal one by the spiral slot and a stud working therein, causing each pulley in turn to become fixed to the shaft and impart motion thereto. As the lateral motion necessary to release one pulley and engage the other is not more than one thirty-second of an inch, it is apparent that the reversal of motion is instantaneous. The simplicity of the device by which these machines are operated, and its low liability to any wear which could impair its action, will generally recommend it. A greater length of stroke is possible by the use of the rack. The speed of the cutting tool is always the same, regardless of stroke. The machine has a cone of two steps, to be used for planing steel, cast iron, or brass, etc.

The invention has been in use about six years by many well known firms. Patented January 20, 1874. For further particulars address the Hendey Machine Company, sole manufacturers, Wolcottville, Conn.



THE MANVILLE PATENT SHAPER.

Electrolytic Decomposition of Water.

M. Bouvet has recently determined experimentally that the decomposition of water by the electric current is independent of the pressure. He has succeeded up to 154 atmospheres, and proposes to continue experiments up to 3,000 atmospheres. The expenditure of electricity is the same under all pressures to decompose a determinate weight of liquid.

Stammering for a Purpose.

The recruiting law of France exempts stammerers from military duty. Of 2,086,826 conscripts examined between 1850 and 1869, there were 13,215 exemptions on account of this defect. The proportion of persons so affected in France is estimated to be 125 per 100,000. The defect is more common in the south than in the north, the difference being attributed to the greater attention paid in the north to primary education and the training of children to read and speak correctly.

The minister of public instruction recommends the abolition of exemption from military service for stammering, since many parents deem it an advantage to their children to stammer, and take no care to have the defect prevented or cured in early childhood. Possibly the law also encourages the willful cultivation of the habit.

Razor Grinding Machinery Wanted.

The only article in the cutlery line in which American manufacturers are unable to compete with the English is razors. This from no lack of skill or steel, but simply because manual labor is too costly with us. There is no machinery with which a razor can be ground fine enough; and it is impossible for our manufacturers to give so much time to their grinding as England does. With the required machinery, however, the field would be open to us. Here is a chance for labor saving machinery to extend the scope of our industries, as it has in so many other instances. The needed machinery will make work in a line from which we are now entirely shut out. Our inventors should look to it.

French Workingmen.

Mr. Smalley, the well known foreign correspondent, does not entertain a very high opinion of French workingmen. The day begins for them nominally at six o'clock, but it is usually half an hour later before they arrive upon the scene of their labors. The first thing they do is to sit down on some convenient stone or bench and have a talk. Pipes come out and are leisurely lighted, and tobacco is a great promoter of conversation. Presently a comrade arrives with a newspaper, which he unfolds and reads aloud, the performance being much enlivened and protracted by continual comment, and followed by a general discussion by the company. All this may last an hour, at the end of which coats are laid aside and the blouse put on, and tools are picked up, and a good stroke of work is done till breakfast. It is the late French breakfast which is responsible for a good part of their dawdling. Breakfast is a solemnity with all classes; with the laboring man scarcely less than with his betters, if betters he have. Perhaps he goes to a café for it, perhaps it comes out of a handkerchief, and is eaten on the thumb; in either case the ceremony is begun, and carried on, and concluded with every circumstance of leisurely deliberation. There is at least as much talk as eating, for the Frenchman is temperate in diet and drink, and takes an hour to dispose of a meal which an Englishman would dispatch in five minutes, asking for more as soon as it was devoured. Then another pipe and more talk; then a stroll back to work; then a discussion how it should be done; in all which the men employed in the vicinity politely take part. This is brotherly, but when it is a question of speed the Frenchman is all abroad. Watching, with a friend, the performances at the Trocadero, where things were more behindhand than elsewhere, and where the need was most urgent, Mr. Smalley saw no indication of haste or anything like zealous activity. "I am not the least overstating," he writes, "when I say that neither of us saw a single man who was working hard, or who kept his tools in his hand for five minutes at a time."

THE PARIS EXHIBITION BUILDING AT THE TROCADERO.

Continuing our series of illustrations of the Paris Exhibition, we present this week a view (see next page), taken from the Place du Roi de Rome, by an artist of the *Illustrated London News*, of the palatial building at the Trocadero, on the right bank of the Seine, which is connected by the Pont de Jena with the main Exhibition Buildings in the Champ de Mars, on the left bank of that river. The mount or rising ground of the Trocadero obtained its name and fame, as a public monument, from the victory of a French military force, in 1823, employed to capture the Spanish fort of the Trocadero in the harbor of Cadiz, for the suppression of a political revolt in the kingdom of Spain. This Palace of the Trocadero was used for the opening ceremony of the Exhibition, and is intended for a series of grand orchestral concerts and other public entertainments, culminating in the official ceremony of distributing the prizes, at a future period of this season. The architects of this stately edifice are Messrs. Davioud and Bourdais. The general style of the building is a modification of the arabesque; its form is semicircular, accompanied by two spacious wings; proceeding from these are half-circular galleries, forming, as it were, the sides of an immense horseshoe as large as the Trocadero itself, and inclosing the whole of the park. From the center of this half-circle springs the rotunda, with its domed roof surmounted by a winged Genius, flanked by two lofty minarets, and encircled by two tiers of galleries, giving access to every part of the internal amphitheater, and forming a covered promenade looking out upon the wonderful panorama of Paris and its environs, Meudon, Sèvres, and Clermont. The architects have succeeded in combining lightness with strength. All the iron framework of the buildings is covered with materials of different colors, placed one over another, and is further enlivened with bright colored panels of enameled clay.

A "ONE MAN POWER" is the raising 70 lbs. 1 foot high in a second for 10 hours a day.

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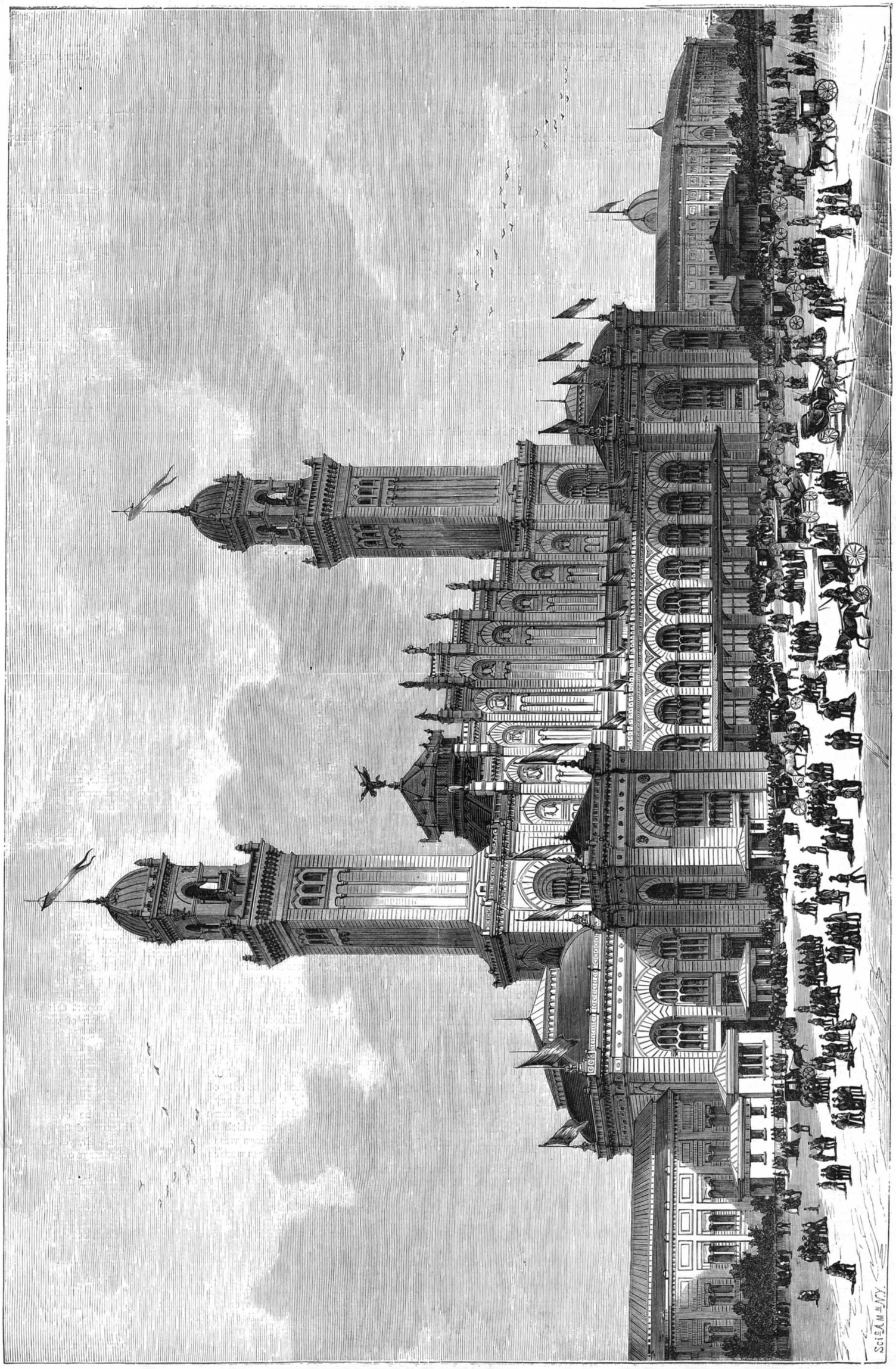

THE PARIS EXHIBITION BUILDING AT THE TROCADERO.—[See preceding page.]

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AFRICAN DIAMONDS.

The diamond, as we all know, is composed of pure carbon crystallized, and is the hardest substance known. Like most other jewels it is found generally in granitic gneiss, and in torrents of rivers or in alluvial deposits that are worked for gold. Distributed more or less over the whole world, it is in tropical countries, however, that this most prized of the "flowers of the mineral kingdom" (as gems have been called) is principally found. Indeed, it would seem that where the sun shines with most splendor, where the animal and vegetable creation put on their most gorgeous colors, there also, in the depths of the earth, this gem assumes its largest proportions, and sparkles with its greatest brilliancy.

The diamond was long known in Asia, in Hindostan, Borneo, Sumatra, and in the Ural Mountains before it was discovered elsewhere; the district from Cape Comorin to the Bay of Bengal, including the famous mines of Golconda, furnishing the world until 1728, when the mines of Brazil were discovered. Recently the latter region has ceased to be profitable, and many of the mines are abandoned, and few retain their full number of laborers. In the United States diamonds have been discovered in North Carolina, Georgia, Virginia, and California, but in small quantities and of little value. In Australia they have been met with in the valley of the Turon, in the bed of the Macquarie River, at Victoria, etc.

On the eastern coast of South Africa two rivers, the Vaal and the Orange, take their rise within a few miles of each other in the Drackensberg Mountains, and, at first flowing in opposite directions, at length gradually sweep around to the west, and unite at some two hundred and fifty miles from their sources. The inclosed space is the republic of the Orange Free State. In 1868 a trader and hunter on his way from the interior, stopping for the night at the hut of a Dutch farmer living at the junction of the rivers, observed the children playing on the earthen floor with some pretty pebbles that they had found long before in the river. The beauty of one of these stones having attracted his attention, he picked it up, and observed to the father that "it might be a diamond." With a smile of incredulity the latter presented the pebble to his guest, remarking that there "were plenty more around there." The stone proved, indeed, to be a diamond of 22½ carats, and was sold for $3,000, which amount was divided fairly by the trader with his host. The farmer now remembered that he had seen an immense stone in the hands of a native; he therefore sought him out, purchased the stone—giving him in exchange 500 sheep, horses, and nearly all that he possessed—and sold it the same day to an experienced buyer for $56,000. This diamond was the famous "Star of South Africa." Thus arose the discovery of the South African diamond fields. Regarding this latest fruitful source of supply of the precious gem, the following information, gleaned from a lengthy paper read by Dr. Wm. J. Morton, before the American Geographical Society, may not prove uninteresting.

The diamond fields of South Africa are located in the small western angle of the inclosure formed by the rivers Vaal and Orange, on a vast plateau which has a general elevation of 5,000 feet above the level of the sea.

The discovery of diamonds in 1868 and 1869 was followed by an excitement that became more and more intense; and from all parts of the colony and from foreign lands people swarmed, and soon a tented city of ten thousand and more grew at Pniel and Klipdrift, on the banks of the broad and beautiful Vaal. Here diamonds were found plentifully and of excellent quality, by sorting over the bowlder drift of the banks. Shifting their quarters up and down the banks, the excited crowds continued to make new discoveries during 1870 and 1871. The tide of fortune soon turned into other directions and assumed mightier proportions. The last stage in the journey to the "River Diggings" is a place called Dutoit's Pan, situated on the open plain, twenty-five miles from the river. Here, in the sand, small diamonds were discovered, and even in the mud that plastered the sides of the proprietor's house. There now occurred a stampede for this place. The mine proved to be a diamondiferous area of about 23 acres, and soon a seething population of 40,000 people had built up a town around it. Old De Beers, a small mine only a mile away, was next discovered. Then came the last and, up to the present time, final discovery of "New Rush," or Kimberly, the site undoubtedly of more natural wealth than any other spot on the globe. In 1871 the British Government stepped in, and by a formal proclamation annexed the whole diamond producing district, under the title of Griqualand West, although it had as formally abandoned and ceded it to the Free State in 1854.

Thus far we have followed the mining population from the "River Diggings" of 1869 and 1870 to the "Dry Diggings" of Dutoit's Pan, Bultfontein, Old De Beers, and Kimberly. Here, then, within a radius of a mile, is the diamond producing industry of South Africa, or rather of the world. Each town is built around its own mine. Three of these no longer enjoy their palmy days; and practically, at the present time all the labor and energy devoted to diamond search is centered in the fourth town, Kimberly—a city in the desert, built of tent cloth and corrugated iron and wood, and here and there substantial brick, and having a population of about 8,000 whites and 15,000 blacks. Six years ago nothing distinguished this spot from any other on the plain of the semi-desert. A party of prospectors from Dutoit's Pan, scratching about in the sand under a tree, found a few small diamonds. Here the soil proved unexpectedly prolific in the gems. At first it was a fine, red, alluvial sand, such as covered the surrounding country. From two to four feet beneath this material a layer of chalk nodules and chalky clay was reached. These nodules also contained diamonds, but were so very difficult to break that the digger, in his haste, threw them aside, and they lie in forgotten heaps about the mine still unbroken. Under the chalk layer came a brittle, yellowish white mass of soft rock; this, too, quite rich in diamonds, and easily workable. As the basin deepened it was found to have a regularly defined edge, of talcose shale, rising like a cliff all around. Outside of this no diamonds could be found, and it was therefore left undisturbed, receiving the name of the "reef." It will make the nature of this "reef" clearer to state that, wherever one excavates either quite near the mine or a hundred miles away, there is found immediately underlying the chalky deposit a layer of this soft, stratified shale, from twenty to thirty feet thick. But over the mines, or diamondiferous pockets, no such layer exists. Some force from below seems to have punched a hole out of this crust, leaving a round basin with edges accurately defined by the rugged edges of the shale. The contents of this pocket or mine—that is, the diamondiferous soil or rock—lie pressed up against the "reef," fitting into its every undulation or crevice.

At a depth of from fifty to sixty feet a very solid conglomerate rock was reached, of a gray-blue color, which received the name of "blue stuff." This at first was supposed to be "hard pan," but proved to be very rich in diamonds, and work was therefore pushed into it with vigor. Most of the large diamonds—that is, from twenty carats upward—are found during the "picking" down in the mine, owing to the fact that the cement like "blue stuff" fractures most easily through the spot occupied by any hard pebble, such as the diamond.

The character of the diamondiferous ground is identically the same in all four of the neighboring mines. It appears to be a pudding stone formed in the presence of water. Its general character is that of a soft, pulverulent ground mass, composed of a mineral soapy to the touch. In this mass are interspersed fragments of shale, round water-worn pebbles of trap, agate and jasper, bronzite and smaragdite, garnet and ilmenite, hyalite and hornstone, calcite and diamonds. After this rock has been thoroughly dried in the sun for several weeks, and then wet with water, it falls to pieces into a soft, slimy, muddy mass. Diamonds are scattered with remarkable evenness throughout this conglomerate. Two are never found together, nor near each other.

In regard to the formation of the mine, the favorite theory is that it is the throat of a mud volcano, and that its contents are the result of decomposition of an original rock below, which contained diamonds. A strong point in favor of such a theory is the fact that the diamonds of each of the four mines are characteristic of it, and their locality generally recognizable. It is certain that the diamond was not formed where it is now found, for every variety of fragment occurs, as well as the perfect stone, imbedded alike in the conglomerate. A half stone with ragged edges of cleavage was certainly never crystallized in a casing which surrounds all its fractured inequalities.

And now a word about the Cape diamond. In general it contains yellow coloring matter, ranging from the faintest straw color to deep orange yellow. But there are also stones as white as any from India or Brazil. With regard to their degree of yellowness they are arranged thus: "White," "Cape white," "bye water," "off color," and "yellow."

A few milky white are found, and now and then pale blue, and even blue, but small. Brown and pink are usual and common, next to the off-colored and yellow. Small green stones are also found. Black and perfect are seldom seen, but black and fractured are common. A curious fact is the "bursting" or "splitting" of a diamond. This occurs only to "glassy stones," which have, be it ever so faint, a tinge of brown in them. Such a stone comes clear and brilliant from the mine, and perhaps in an hour a little "feather" or fracture points towards its center; or, laid aside for the night, it is found in the morning lying in fragments. The "splitting" is due, probably, to the water absorbed between its laminæ having dried out. The Cape diamond has no adhering skin or envelope, as is the case with the Brazilian; it shines like a piece of bright glass wherever it is found.

As before stated, the diamonds from the river and the four mines have recognizable peculiarities. Those from the river are invariably water worn, looking like ground glass; but they are noted for being whiter, and bring a higher price than any other.

Stones from Dutoit's Pan are large, off-colored, and yellow.

The stones from Bultfontein are entirely different. They are small, beveled octahedrons, and pitted so that they appear frosted.

The diamonds from Kimberly are, as a rule, not as large as those from Dutoit's Pan, but they are whiter. The popular notion that the Cape diamonds are all yellow is a myth—many of them are white. As to their yield they may be thus classified: 10 per cent first quality, 15 per cent second quality, 20 per cent third quality, and the remaining 55 per cent consisting of "bort," used for cutting diamonds and other stones. There is no "carbon" or "black diamond," such as found in Brazil, and which is now so generally used in the various diamond saws and drills. The exports from the Cape mines up to the end of the year 1876 reached the sum of $85,000,000. This does not represent the total product, for both digger and diamond buyer carry home privately large packages of diamonds whose value would largely increase this amount.

Although the diamond, in value, ranks below the ruby, it is always supposed to take precedence of other gems; the reason being, perhaps, that its commercial value is most constant. It will always remain a royal gem; it never can become common. Nature has placed it in lands difficult of access; and as far as known the world's future supply is sparsely scattered in the depths of a seven acre mine.

PHYSIOLOGICAL EFFECTS OF THIRST.

Last summer a company of the 10th U. S. Cavalry nearly perished of thirst during a four days' march without water, among the arid sand hills of the Staked Plain of Texas. They set out in pursuit of a band of marauding Indians, and toward sunset of the first day the trail they had followed broke up into a multitude of ill-defined tracks, making further pursuit useless. By this time their canteens were dry, and the men were so exhausted by the intense sun heat that many fell from their saddles. All the afternoon their guide had searched in vain for water among the hills, and now the horses were suffering from thirst scarcely less than their riders. The captain's private horse, the toughest of the party, was given to the guide, who set out in search of water, but was never seen again.

The next day an attempt was made to fall back upon "Double Lakes," where water was expected, but having no guide they lost their way, and wandered for three days among the hills before water was found. During this time their suffering from heat and thirst was terrible. The salivary and mucous secretions were dried up, and the sensibility of the mucous membranes of the mouth was so much impaired that they could neither swallow nor even perceive when anything was in the mouth. Brown sugar remained like dry sand in the mouth. Their voices became weak and strange; all were deaf, and appeared stupid to each other, questions having to be repeated several times before they could be understood. Vertigo and dimness of vision affected all. Many were delirious, and all tottered on with feeble and stumbling gait. What little sleep they could get was disturbed by dreams of banqueting, with visions of every imaginable dainty to eat and drink.

At this stage all would probably have perished had they not resorted to horses' blood. As the animals gave out the men cut them open and drank their blood, almost fighting for the little moisture contained in their viscera. Later the horses' blood became so thick from lack of drink that it could not be swallowed. It coagulated instantly, and had to be broken up between the teeth and slowly forced down the parched throats. And when swallowed it gave no relief, quickly passing through the bowels, developing diarrhea. Their own scanty urine was sweetened with sugar and thankfully drunk, and a few drank horses' urine. Usually, however, it was caught in cups and given to the suffering animals.

To avoid the terrible mid-day heat they traveled as much as they could by night. As they toiled on they suffered severely from tightness of breath and a sense of suffocation. It seemed as though the sides of the trachea were adhering. To mitigate the consequent distress they breathed through the nose with closed mouth, prolonging the time between the breaths as much as possible. At this stage the lips were covered with a whitish dry froth, and presented a ghastly aspect. The fingers and palms were shriveled and pale; and some who had removed their boots suffered from swollen feet and legs.

As the situation became more desperate, mental tortures were added to the purely physical. The feeling of despair was made worse by suspicion and loss of confidence in each other. Toward the end persistent wakefulness aggravated the mental anguish, though they tried to sleep at every halt. At last, on the morning of July 30, a part of the command succeeded in reaching Double Lakes, and a supply of water was sent back to those along the road. The fortunate arrival of a detachment of Yonkoway scouts at this moment helped to save many. On reaching water the desire to drink was irresistible. They could not refrain from pouring down water, though it was immediately rejected by the stomach. Warm coffee was the only thing that revived them at all.

Assistant Surgeon King, from whose report this account has been condensed, remarks that the failure of water to assuage the thirst, though drunk again and again to repletion, seems to show that the sense of thirst, like that of hunger, resides not in the stomach, but in the general system, and could not be relieved until the remote tissues were supplied. And the activity of the regenerating process was prevented by the deficiency of water in the absorbent vessels themselves. The same condition explains the overpowering dyspnœa which threatened the existence of the company. Their lungs were filled with the purest air, yet the lining membranes were so dry that the free passage of the oxygen to the blood was prevented.

It is a noteworthy circumstance that while the horses suffered much as the men did, and many gave out completely, the mules suffered little, and were able to graze at every halt. The total loss on this disastrous scout was two men dead and two missing, probably dead, out of twenty-six privates and two commissioned officers.

La Nature says that a French inventor has recently proposed a perpetual clock, based on the difference of atmospheric temperature by day and by night. The heat of day causes a liquid to rise into a reservoir, whence it falls by gravity, so operating the mechanism. This is a very old idea. More than twenty years ago we saw a form of perpetual clock in this city which was wound by the diurnal rise and fall of a column of oil.

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ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, June 8, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury rises	3 27 mo.	Jupiter in meridian	3 31 mo.
Venus rises	2 29 mo.	Saturn rises	0 59 mo.
Mars sets	9 50 eve.	Uranus sets	11 33 eve.
Jupiter rises	10 40 eve.	Neptune rises	2 35 mo.

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Alpheratz rises	11 01 eve.	Regulus sets	11 36 eve.
Algol (var.) rises	0 45 mo.	Spica in meridian	8 10 eve.
7 stars (Pleiades) rises	5 04 mo.	Arcturus in meridian	9 01 eve.
Aldebaran rises	4 34 mo.	Antares in meridian	1 27 mo.
Capella sets	10 07 eve.	Vega in meridian	11 12 eve.
Rigel rises	8 27 eve.	Altair rises	8 06 eve.
Betelgeuse sets	7 05 eve.	Deneb in meridian	3 31 mo.
Sirius sets	6 32 eve.	Fomalhaut rises	1 45 mo.
Procyon sets	8 43 eve.		

REMARKS.

The conjunction of Mars with the moon alluded to last week will be witnessed as an occultation throughout Western Europe. Their conjunction in right ascension, Greenwich, England, occurs at 9h. 17m. 29·2sec., evening. Jupiter and the moon are in conjunction June 18, 1h. 3m., morning. This will be an occultation on this continent south of 24° north latitude. The star Φ *Sagittarii* (3d mag.) is occulted by the moon June 15, 9h. 26m., evening, the star passing very nearly behind the moon's center. This star is in the Milk Dipper, a conspicuous figure composed of five 3d and 4th magnitude stars. The handle, a short, straight one, projects westward into the Milky Way, hence the name, and the bowl is nearly bottom upwards. φ is the star which forms the junction of the handle to the bowl. The minima of Algol are still invisible.

One Source of Tramps.

The secretary at Castle Garden Emigrant Depot, New York city, reports an encouraging falling off in the number of undesirable immigrants received at this port; still they continue to come in large numbers. All are examined, and if there is reason to think that any are likely to become public charges they are invited to return whence they came; but they cannot be compelled to go. Since 1847 six million immigrants have been landed at this port. Most of these have become profitable citizens; yet very many, having no trade or profession, nor any habits of thrift, have resorted to beggary, and formed the nucleus if not the rank and file of the great army of tramps and professional beggars that have become such a dangerous nuisance throughout the land. In a single twelvemonth, a few years ago, about 7,000 of this class were received at this port. Two years ago a large number of Danish convicts arrived, but their character was discovered in time to secure their immediate return. It is less easy to detect those who are or are likely to become paupers, and when they are detected there is no law compelling their return. Last year the Emigration Commissioners found employment for over 10,000 persons.

PROPOSED THAMES BRIDGE.

On page 329 of the SCIENTIFIC AMERICAN of May 25, 1878, was presented an illustration of one of three alternative plans proposed by Sir Joseph Bazalgette for the new bridge which it is intended to throw across the Thames at London, near the Tower. We now copy from the London *Engineer* another design, considered the most advisable of the three. This involves the construction of an arch of 850 feet, the largest in the world, the bridge thus crossing the river at a single span. To those unfamiliar with the progress of modern bridge work the scheme is a startling one, but it is pronounced by good authority to be perfectly practicable. Although enormously expensive, to offset this such a bridge would be correspondingly substantial and lasting, would not obstruct navigation, and would dispense with the space required for the anchorages of a suspension bridge.

M. BECQUEREL.

M. Becquerel, the distinguished French physicist, whose portrait we present herewith, and who died, as we have already announced, in January last, at the advanced age of ninety years, was the founder of the science of electro-chemistry. He was the first to discover that electricity is one of the results of chemical combination, and that it is produced by the action of acids on metals, and the first to construct elements of two liquids separated by a partition, thus inventing a battery possessing a constancy and regularity of action hitherto unknown. He invented the electric thermometer, by which from a distance the temperature of the interior of animals and vegetables, as well as that of elevated regions of the atmosphere, may be determined, and also the electro-magnetic balance and the differential galvanometer. He also made investigations of great importance in meteorology, notably on the climatic changes due to forests. He was a most indefatigable worker, continuing his elaborate researches, despite his great age, up to the period of his death. We are indebted to *La Nature* for our illustration.

M. BECQUEREL.

Fish Notes.

Professor Baird intends to stock all the muddy bottomed waters of the United States with carp, an excellent hardy fish, which always remains where raised. A few days ago about 50,000 young carp were put into Lake Babcock, near Washington monument, Washington. They were hatched in Baltimore.

Commissioner Roosevelt complains that shad are being caught in the Hudson River and New York Bay at an age when they are entirely too small. They weigh from half a pound to a pound and a half, and are sold for five cents. If let alone they would in a year or two weigh from three to five pounds and be fit for the table. Such a destruction of half grown shad must lead to a diminution in the supply, in spite of all efforts to replenish the fisheries, and should be prevented if possible. There is great danger that unless the fishing is regulated, both as to the times when it is permitted and the size of the meshes of the nets, many of our most valuable seacoast and migratory fishes will soon be things of the past. Since the legislature will not pass the needed laws, the public can do something to protect the fish by refusing to buy those that are undersized.

A few years ago the Fish Commission began the experiment of restocking the Connecticut river with salmon. Results are beginning to appear in the form of ten and fifteen pound fish, quite a number of which have been taken in shad nets in the lower part of the stream this spring. It is to be hoped that the fishermen will be sufficiently lenient to the new comers to allow them an opportunity to multiply as of old.

New Mechanical Inventions.

Mr. O. E. Davidson, of Clarksville, Tenn., has invented a machine for Making Paper Bags, which pastes a continuous strip of paper along both edges and cuts off a blank of proper length to form a bag; then a vertically acting blade or former descends and bends the blank at the middle; hinged side folders fold the sides of the blank around the former; bottom folders then come into operation, after which the former rises, leaving the bag supported on a hinged table, which at once falls and allows the bag to slide down to the pressing and delivery rolls.

The same inventor has also secured a patent for the Paper Bag made by the machine described above. The bottom is made continuous by folding the middle of the blank, and the side edges are double seamed, thus giving unusual strength.

An improved Cloth Measuring and Pressing Machine has been invented by Mr. C. Q. Smith, of Maryville, Mo. The frame is adjustable in width, to adapt it to receive bolt boards of different lengths. A tape line on a reel attached to the machine is unwound and measures the cloth as the latter is rewound upon the bolt board.

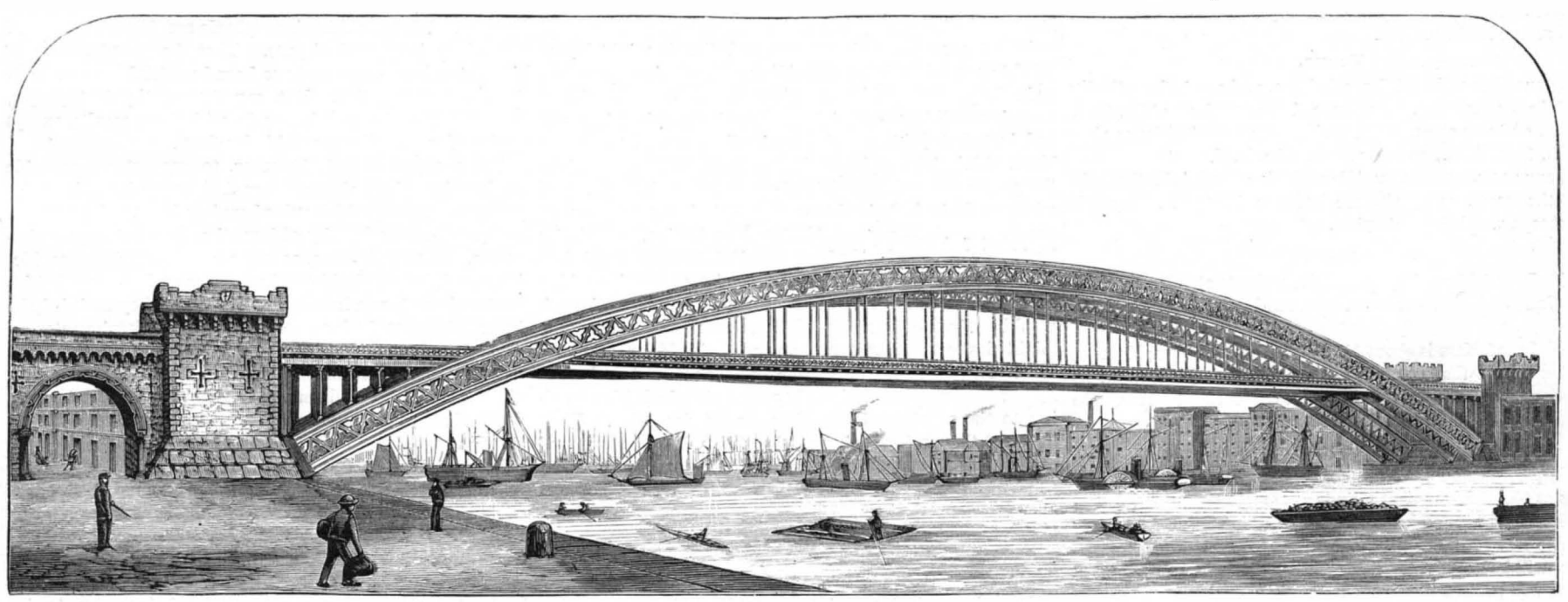
In a new Log Carrier, invented by Mr. W. Lamb, of Green Bay, Wis., the construction and arrangement of parts admit of the power of an independent steam engine being applied direct to the shaft of the winding drum, instead of being derived from the main shaft of the sawing machine through belting or other similar means.

Mr. A. K. Waddill, of Denison, Texas, has improved upon the ordinary mode of Locking Car Seats, by placing the locking rod in a lengthwise recess in the side of the car, and in providing it with lugs, which catch over the pivot arms of the reversible backs, and with a rigid arm, which serves both as a means for operating the locking bar and also for securing or fastening it when properly adjusted for locking the seat backs.

Mr. D. Hess, of Evansville, Ind., has made an improvement in Grinding Mills, which consists in constructing the buhr of a series of concentric cylindrical saws combined with a flanged disk, and secured therein by pins passing through the flanges of the disk, so that the saws may not only be separately sharpened by filing, but may be worn down indefinitely without interfering with the attachment of the saws, and without the necessity of renewing the buhrs.

In Operating Oil Wells it is sometimes the practice to allow a steady stream of oil to escape from the side of the pump or tube, which, owing to the pressure of the column of oil above it, has a great effect in enlarging the hole in the rock through which the pump passes, and in breaking up any accumulation of matter that would tend to prevent successful pumping. Mr. L. W. Young, of Elk City, Pa., has, however, found that an intermittent stream accomplishes these objects to a better advantage, besides allowing a part of the oil to pass upward, which returns into the well when the stream is continuous. He has, therefore, invented an automatic valve action, attached to the pump rod, which regulates this intermittent stream.

Mr. Wm. Coupe, of South Attleborough, Mass., has improved upon the Machine for Boarding or Breaking Raw Hides previously patented by him, by making the cribs in



PROPOSED SINGLE-ARCH BRIDGE OVER THE THAMES.

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which the hides are treated capable of exact adjustment to the number and size of the hides, so as to fully control the degree of boarding to which they are to be exposed.

An improved Tile Machine, invented by Mr. Miles Moore, of Liber, Ind., consists of a mixing mill in combination with an eccentric plunger, the latter working in a chamber having two discharge spouts, which are provided with suitable moulds for forming the tiles.

Mr. H. Mortensen, of Alma, Col., has designed a Torpedo Boat intended to be operated at the surface or wholly under water, according to circumstances. Compressed air is used to drive the greater part of the machinery, and the special improvements relate to the mode of loading and projecting the torpedo spars, excluding the water, and operating the rudder.

Mr. J. Doyle, of Lowell, Mass., has invented an improvement in Thread-Guard Supports for Ring Spinning Frames, intended to hold the guards between adjustable spindles, so that they can prevent the yarn of two adjacent bobbins from coming in contact, and also avoiding attachment to the ring rail. The guards are held in pendent position and regulated by means of a weighted arm and stop bar.

In a new Traction Engine, invented by Mr. M. Fortin, of Stillwater, Minn., the arrangement is such that in winter runners may be used instead of wheels, thus converting the engine into a steam sleigh; and the water in the boiler is so distributed as not to be thrown all at one end or side, exposing the flues at the other end or side to burning, in going up or down hill or over uneven roads.

An improved Blind Adjuster and Fastener, invented by Mr. T. Corrigan, of Brooklyn, N. Y., is designed to enable window blinds to be opened, closed, adjusted at any desired angle, and securely fastened in the various positions without it being necessary to raise the sash.

MM. R. Seillière and L. Riot, of Paris, France, have secured an American patent on a system of Using Superheated Steam, in which the steam is superheated during its passage from the generator to the engine, without the interposition of any valves between the superheater and generator, the outlet from the boiler being reduced in area, and the size of the superheater augmented to the utmost extent possible. The superheater consists of a number of very small tubes in the smoke box, a secondary superheating coil in the fire box, and a storage reservoir, from which the superheated steam goes to the cylinder.

Mr. S. Cottle, of New York city, has invented an improved process of making Collar or Sleeve Buttons, which consists in striking up and drawing out the central portion of a circular metallic disk to form a hollow post, then severing the conical end of the post and soldering the head upon it.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although merely approximate, they are sufficiently accurate to enable the observer to find the planets.

M. M.

Position of Planets for June, 1878.

Mercury.

Mercury, having come between the earth and the sun, passed across the sun from east to west, and is therefore in June west of the sun. It rises on June 1 at 3h. 33m. A.M., and sets at 5h. 11m. P.M. Early in June it can be well seen before sunrise. On June 30 Mercury rises at 4h. 8m. A.M., and sets at 7h. 18m. P.M.

Venus.

Venus rises early all through June, and can be beautifully seen in the morning. On June 1 Venus rises at 2h. 34m. A.M., and sets at 3h. 35m. P.M. On June 30 Venus rises at 2h. 11m. A.M., and sets at 4h. 27m. P.M.

Venus comes to the meridian a little after 9 A.M. throughout the month at an altitude between 57° to 67°. A small telescope will bring it to view.

Mars.

On June 1 Mars rises at 7 A.M., and sets at 10h. 4m. P.M. On June 30 Mars rises at 6h. 39m. A.M., and sets at 9h. 12m. P.M.

On June 1 Mars is about 1½° above δ Geminorum; it passes to the east of that star and farther south in declination; its motions can be watched in the early evening hours. On June 30 Mars sets as Jupiter rises.

Jupiter.

Jupiter rises on June 1 a few minutes after 11 P.M., and sets at 8h. 45m. the next morning. On June 30 Jupiter rises at 9h. 7m. P.M., and sets at 4h. 40m. the next morning.

The 7th, 14th, and 21st, according to the *Nautical Almanac*, will be the nights of June in which the satellites of Jupiter will present the most interesting positions. On the 7th the first and second satellites with their shadows will be on the face of the planet at the same time, between midnight and one in the morning. The same will occur again on the 14th in the later morning hour. With a powerful glass the two moons and their two shadows may all be seen on the planet's disk.

Saturn.

On June 1 Saturn rises at 1h. 34m. A.M., and sets at 1h. 24m. P.M. On June 30 Saturn rises at 11h. 43m. P.M., and sets at 11h. 37m. A.M. of the next day.

Saturn, although apparently and really much smaller than Jupiter, is in better position for observation in the June mornings, as it comes to the meridian at a much higher altitude. On June 30 Saturn will be on the meridian at 5h. 32m. at an altitude of 48°.

The three planets, Venus, Jupiter, and Saturn, will make the hours of June which precede daylight very beautiful.

Uranus.

Mars and Uranus are the only planets which can be found in the June evenings, and Uranus can rarely be seen with the naked eye. On June 1 Uranus sets at midnight, and on the 30th it sets at 10h. 11m., still in the neighborhood of Regulus, and west of it.

NOTES OF PATENT OFFICE DECISIONS.

In the interference case of Stearns vs. Prescott, the examiner found that Stearns was the first and original inventor, but that the invention was reduced to practice by him and publicly sold for more than two years prior to the date of filing his application. This being a statutory bar to the grant of a patent to Stearns, the examiner, while awarding priority to him, at the same time reported this fact to the Commissioner, as provided by office rule 59. The counsel for Stearns thereupon requested that he might be allowed sufficient time to file affidavits to fully explain all matters relating to his invention, its conception and reduction to practice, in order to establish conclusively that the use prior to the time provided for by law was of an experimental character, and should not operate to deprive Stearns of his patent.

The Acting Commissioner denied this request. The very purpose of the interference was to develop the history of the invention on the part of the contestant, and it was necessary for the applicant to adduce proof showing not only that he had completed the invention experimentally, but had actually reduced it to practice before the patentee, in order to establish priority against the latter. The fact of abandonment by public use or sale must be established by indubitable proof; and if there be any doubt upon such point, that doubt should be resolved by the office in favor of the applicant. If the proof was not sufficient to establish the fact of abandonment clearly, the applicant should be allowed a patent. On the other hand, if the proof of public sale for more than two years prior to the filing of the application was established against the applicant by the testimony already taken, it would be simply disproving his own case by counter affidavits to allow him, after the hearing, to show that such was not the fact. The Acting Commissioner accordingly held that it would be establishing a very bad precedent, if, after a party had set forth the dates of the conception, completion, and use of his invention in a proceeding especially adapted for that purpose, he were allowed, upon obtaining an award of priority, to proceed to rebut or explain away the very proof, perhaps, upon which such judgment had been based.

Warburg & Co. applied to have registered as a trade mark the term "Cachemire Milano," to be applied to black silks, the term to be used in connection with the words "R. Savie & Co.," and with a picture of the Cathedral of Milan.

If not previously registered in connection with the same class of goods, the picture of the cathedral would undoubtedly be a proper trade mark; but the applicant asserted that the essential part of the mark was the word symbol "Cachemire Milano."

The decision of the Examiner of Trade Marks on this point was as follows: "The word 'cachemire' or 'cashmere' is not arbitrarily selected as a mark for silks, because it might easily have reference to a peculiarity of the silk. It would be the appropriate and only appellation for a fabric uniting the qualities of cashmere and silk; it might be applied to a species of silk resembling cashmere in appearance, or in the processes of its manufacture. As a matter of fact, there is a well known variety of silk, characterized by a soft and lusterless finish, which goes by the name of 'cashmere black silk.' The applicant is, therefore, seeking to register the proper name of an article of commerce, and his proposed mark would in fact give him a monopoly in the sale of such goods. . . . The word 'Milano' or 'Milan,' which by itself might conceivably be a fanciful term as applied to silk, becomes itself insignificant from its connection with a descriptive term, and to allow the applicant to register it would prejudice the rights of those resident in Milan who might desire to manufacture and advertise Milan cashmere silks. In case it should be held that the words 'Cachemire Milano' are not descriptive, they must then be held, according to the practice of the office, to be deceptive. They have not the merit of being newly coined, like 'castroleum' or 'cocoaine,' nor of being symbolically used, as 'rising sun,' when applied to an article of commerce. They are, in their proposed use, merely a misnomer, and are calculated to deceive. An inspection of the goods might or might not undeceive the purchaser; but this does not go to the essence of the objection. The mark is false and tends to deceive, and that is conclusive against the applicant."

This decision of the Examiner of Trade Marks is adopted and affirmed by the Acting Commissioner.

The New Process of Flour Making.

Almost everybody knows of the flour, but not every one understands what it is. Stripped of technicalities, this is perhaps about the story of its manufacture. The best flour used to be made of winter wheat. Spring wheat yielded either much less in quantity, or else so much of the bran got into the flour in its manufacture that its color was intolerably dark. The wheat would be ground and then bolted. In the refuse —the bran and middlings—would be included a large proportion of the weight of the spring wheat, and this would sell more particularly for feed for horses. Now the best of flour, and the most expensive, is made of this very refuse of the old-fashioned process. It all came out of the discovery of a way to draw out the bran. Under the new process the wheat is ground about as before. The first result is an ordinary flour sold for exportation. Then the remainder is taken and put upon great horizontal sieves, and, while agitation is going on there, an ingenious system of draughts, rushing up through, carries off the bran. What is left is the glutinous portion of the wheat, the most nutritious and most productive, and out of this, purified now by the drawing off of the bran, we get our new process flour.

The result of the discovery of the process has been to make the poor spring wheat of Minnesota and upper Wisconsin the most valuable kind of grain, and to make the fortunes of the inventors of the method.—*Hartford Courant.*

IS IT A MERE COINCIDENCE?

Speaking of Edison's phonograph, the New York *Herald* remarks that "the Americans are the most inventive people in the world, and besides a multitude of minor inventions of more or less utility they have contributed more than their share to those greater conquests of man over nature which outrank all the other intellectual achievements of our time. Even in the early beginnings of our history, at a time when our population had not reached two millions, Franklin's discoveries in electricity gave him a pre-eminence in that fruitful branch of science which will never be eclipsed. When he announced his capital discovery of the identity of lightning and electricity the Royal Society laughed at his theory, but the laughers were soon subdued by the cogency of his experiments, and the Royal Society in 1753 made amends by conferring on him, unsolicited, its highest honor, the Copley medal. It was thus an American who set in motion the train of discoveries whose most important practical result is the electric telegraph. It was our Morse who made the final application and established the first telegraph. It was our Fulton that made the first successful application of steam to navigation. Our Draper preceded Daguerre in making sun pictures, although the Frenchman got ahead of him in turning the discovery to use. That most beneficent discovery of the age, the use of anæsthetics in medicine and surgery, is of American origin. All the things on which we have now touched, as well as the latest invention of Edison, deserve a place in the highest ranks of successful physical research. Of inventions which consist in purely mechanical applications of well known principles Americans have distanced all competition in multitude, in variety, and in importance. A catalogue even of the most useful and noteworthy would be tiresome by its length. To say nothing of Whitney's cotton gin and other early inventions, enough has been done in the lifetime of persons still young to confer luster on American ingenuity. The sewing machine, the mowing and reaping machines, the machines for planting seeds and thrashing grain, are a few among the many which are as the leaves of the forest for multitude. Without dwelling on achievements which have gone into history we may safely challenge all Europe to show an inventive genius who deserves to stand by the side of Edison."

There is, we are told, a large class of intelligent persons —a larger class than is generally supposed—who favor an entire repeal of our patent system, as one for which there is no necessity, and from which we derive no commensurate benefits. That the American people are inventors beyond all others is beyond dispute. That the grand results of American inventiveness have been beneficial no one is so foolish as to question. But, say these anti-patent people, the patent law has nothing to do with these results, except perhaps, to complicate and hinder them.

These objectors fail, however, to suggest a reasonable explanation of the circumstance that every incentive to invention (save one) which exists here is to be found elsewhere, and yet the same fertility of invention does not appear elsewhere. It may be true, as some assert—for instance Mr. Raymond, before the House Committee on Patents—that inventors invent, as a hen lays eggs, because they can't help it; but what makes the inventor? And what makes inventors so exceptionally numerous here? The best that Mr. Raymond can offer is that the inventive genius of the American people "seems to be indigenous to the very soil!" And we doubt if any one can offer a better answer without hitting the right one.

For our part, seeing that the original inheritors of this remarkable soil never passed beyond the bow and arrow stage of invention, we are compelled to think that its strange and tardy productiveness must have been awakened by some outside influence. And after eliminating all the influences shared equally by our civilized kindred in other lands, and finding the one exceptional incentive to invention which has prevailed here to be a patent system uniquely favorable to inventors, we are forced to accept it as the true cause of the superior fertility of the American people in this field of useful effort.

A Good Year's Work.

The *Railway Age* asserts, on the strength of considerable correspondence relative to the achievements of locomotives, that the best running on record is that of one of the locomotives of the Western Maryland Railroad. According to the statement of Manager Hood, that engine made the extraordinary run of 59,953 miles in one year, at the low rate for repairs of one and one half cents per mile run.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Automatic Cut-off Engines, and the best, cheapest, and most economical, Balanced Slide Valve, Throttling Engine in the Market. Buckeye Engine Co., 37 Liberty St., New York.

Portable and Stationary Engines; Boilers of all kinds; 45 Cortlandt St., N. Y. Erie City Iron Works, Erie, Pa.

Alcott's Turbine received the Centennial Medal.

Vertical Scientific Grain Mills. A.W.Straub & Co.,Phila.

Cornice Brakes. J.M. Robinson & Co., Cincinnati, O.

Sperm Oil, Pure. Wm. F. Nye, New Bedford, Mass.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Painters' Metal Graining Plates. J.J.Callow,Clevel'd,O.

For Swivel Head Engine Lathes, address Geo. Gage. Waterford, N. Y.

Bolt Forging Machine & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

J. F. Tallant, Burlington, Iowa, makes a specialty of saving Fuel and increasing power of Steam Engines.

Pulverizing Mills for all hard substance and grinding purposes. Walker Bros. & Co., 23d and Wood St., Phila.

Daniels' Planers of all sizes, both new and 2d hand. Send for circular. Steptoe & Co., 214 W. 2d St., Cin., O.

Safety Linen Hose. Protects factories and stores. Saves insurance. Greene, Tweed & Co., 18 Park Place, N. Y.

For Sale.—Electro Plating Shop cheap; established 2 years; good business. H. B. Chamberlin, 78½ 4th St., Louisville, Ky.

Machinists' Tools. New and Second hand. Geo. Gage, Waterford, N. Y.

For Town and Village use, comb'd Hand Fire Engine & Hose Carriage, $350. Forsaith & Co., Manchester, N. H.

Patentees, etc.—Correspondence is solicited from parties desiring goods manufactured from Iron or Steel, by a firm having unusually good manufacturing facilities, and who are willing to make and introduce any good articles suitable for the Hardware Trade, upon royalty or otherwise. Address, in first instance, Chas. P. Thore, 105 Fulton St., New York.

Zero Refrigerator, with cooler. Centennial award. Send for catalogue. A. M. Lesley, 372 Sixth Ave., N. Y.

Patent Agency.—J. R. Howell, Atlanta, Ga., will exhibit Models and represent Inventors.

F. Lunkenheimer's Brass Goods for Engine Builders, Automatic Oil Feeders, Glass Oil Cups, Cody Shaft Oilers, etc. Address Cincinnati Brass Works.

Wanted.—A Second-hand Foot Lathe and a Scroll Saw. Must be cheap and in good order. Address, with full particulars, W. F. Keeler, Mayport, Fla.

Best Steam Pipe & Boiler Covering. P. Carey, Dayton, O.

Polishing Tools and Supplies. Send for new price list. Greene, Tweed & Co., 18 Park Place, N. Y.

Best Turbine Water Wheel, Alcott's, Mt. Holly, N. J.

1,000 2d hand machines for sale Send stamp for descriptive price list. Forsaith & Co., Manchester, N. H.

For Brush Makers' Machinery, address Geo. Gage, Waterford, N. Y.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J.

Cheap but Good. The "Roberts Engine," see cut in this paper, June 1st, 1878. Alse horizontal and vertical engines and boilers. E. E. Roberts, 107 Liberty St., N. Y.

Foot Lathes, Fret Saws, 6c., 90 pp. E.Brown, Lowell, Ms.

Warranted best and cheapest Planers, Jointers, Universal Woodworkers, Band and Scroll Saws, etc., manufactured by Bentel, Margedant & Co., Hamilton, Ohio.

For Shafting, Pulleys, Hangers, etc., send for price list and discount to Hilles & Jones, Wilmington, Del.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburgh Steel Casting Company, Pittsburgh, Pa.

Wm. Sellers & Co., Phila., have introduced a new Injector, worked by a single motion of a lever.

Valuable Invention to users of Steam Boilers. See advt., page 318, last issue. Address U S. Automatic Stoker Co., No. 2 Chestnut St., Philadelphia, Pa.

Presses, Dies, and Tools for working Sheet Metals, etc. Fruit and other Can Tools. Bliss & Williams, Brooklyn, N. Y., and Paris Exposition, 1878.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St. Wm. Sellers & Co.

Improved Wood-working Machinery made by Walker Bros., 73 and 75 Laurel St., Philadelphia, Pa.

The great Wheelock Engine, which furnishes the power to the machinery of the American Exhibit at the Paris Exposition this year, is lubricated by Patent Lubricene and Cups. Our exhibit will equal that which we made in Philadelphia in 1876. R. J. Chard, 134 M. Lane, N. Y. city.

Friction Clutches for heavy work. Can be run at high speeds, and start gradual. Safety Elevators and Hoisting Machinery a specialty. D. Frisbie & Co., New Haven, Ct.

The only genuine Geiser Self-regulating Grain Separator. Address the Geiser Manuf. Co., Waynesboro' Franklin Co., Pa.

Wrenches.—The Lipsey "Reliable" is strongest and best. Six inch sample by mail 60 cents. Roper Caloric Engine Manufacturing Co., 91 Washington St., N. Y.

The Cameron Steam Pump mounted in Phosphor Bronze is an indestructible machine. See ad. back page.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

For Power&Economy, Alcott's Turbine, Mt. Holly, N.J.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

For the best Bone Mill and Mineral Crushing Machines—five sizes, great variety of work—address Baugh & Sons, Philadelphia, Pa.

Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.

Machine Cut Brass Gear Wheels for Models, etc. (New List.) D. Gilbert & Son., 212 Chester St., Phila., Pa.

Boilers & Engines cheap. Lovegrove & Co., Phila., Pa.

Address Star Tool Co., Providence, R. I., for Screw Cutting Engine Lathes of 13, 15, 18, and 21 in. swing.

Skinner Portable Engine, Improved, 2 1-2 to 10 H. P. Skinner & Wood, Erie, Pa.

Notes & Queries

(1) E. A. C. asks: Which side of a belt should run next to the pulley, the finished or flesh side? A. In practice the finished side is found to give the least slip.

(2) G. M. K. & Co. ask: 1. How much water will 1 lb. of anthracite coal convert into steam at 70 lbs. pressure, in an ordinary boiler? A. 8 or 9 lbs. 2. How much steam will 7,000 feet of 1 inch pipe, in lengths of 60 feet, connected with 4 inch supply pipes, condense in an atmosphere of 125°? A. While an exact determination of this can only be made by experiment, you can calculate it approximately on the assumption that each square foot of the pipe will radiate 2·9 units of heat per hour for each degree in difference between internal and external temperature.

(3) W. J. C. asks: How many drops of water are there in a pint A. At 60° Fah., about 7,680.

What is the volatile liquid generally used in making ice, and is it injurious to solder, tin plate, copper, zinc, and vegetable tissues? A. Machines employing anhydrous sulphurous oxide, ammonia, or the light hydrocarbon oils or ethers, have, we believe, met with the greatest success. None of these liquids have action upon the metals mentioned when properly managed. On vegetable tissues, gums, etc., the former have the least action.

What is the thickness of a soap bubble, say of 4 inches in diameter? A. The film is not of constant thickness; it varies between 0·0001 and 0·000017 of an inch.

(4) J. L. F. asks: What will render timber fireproof? A. Saturate it as far as may be with strong hot aqueous solutions of sodium tungstate (crude), silicate (water glass), or sulphate; ammonium sulphate has also been used. Wood thus prepared is not ignited by sparks or transient contact of flame. Unaltered woody fiber cannot, however, be rendered, by these or other simple means, incombustible.

(5) M. V. O. asks: How are the steel faces fastened on cast iron anvils and malleable iron scissors? A. The faces are put in the mould, and the melted cast iron is allowed to run through the mould until the steel faces are welding hot. Then the flow of metal through the mould is stopped and the casting poured, welding the steel to the iron.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

Hydrophobia Cure. By A. J. B.
Bursting of Fire Hose. By A. H.
Paper Barrels. By J. N., Jr.
Torpedo Balloons. By J. C. M.
Virginia Gold Mines. By J. E. E.
Prevention of Explosions in Flour Mills. By J. R. V.
A New Percussion Shell. By F. W. P.
Lucky and Unlucky Days. By E. G. B.
The Star Wheel Feed. By T. J. B.
Singular Locomotive Accident. By W. J. T.
Boiler Explosions. By J. W. S.
Cochituate Water. By W. B.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

April 9, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Advertising medium, B. C. Baker 202,214
Awning frame, C. Kingseed 202,272
Ax, T. K. Downing 202,159
Bale tie, W. S. Davis 202,242
Barrel pitching machine, H. Lehmann (r) 8,168
Basin and urinal, J. Reid 202,193
Bath, J. Ketzscher 202,270
Bed bottom, H. S. Cate 202,149
Bed bottom, T. & J. N. Tracy 202,302
Bed, sofa, A. Hansen 202,108
Bedstead, invalid, A. J. Goodwin 202,106
Bedstead, wardrobe, A. Stark (r) 8,161
Bee hive, C. R. Macy 202,114
Bit for horses, J. H. Robinson 202,195
Bolt, door, F. Davis 202,158
Books, preparing fly leaves for, E. Crawley 202,156
Boot and shoe, F. Goff 202,256
Boot and shoe, tap sole, D. R. Proctor 202,191
Boot, lady's, J. Dean 202,244
Bottle stopper, A. E. Barthel 202,138
Bottle stopper, N. Fritzner 202,100
Bottle stopper, W. G. Whitman 202,320
Bottle stopper fastener, A. E. Barthel 202,137
Bottle, measuring stopper, W. L. Keller 202,268
Brick kiln roof, T. F. Adams 202,212
Bridle rosette, N. Le Blond 202,111
Bung and bushing, P. K. O'Lally 202,284
Butter mould, H. A. Rees 202,120
Cane, G. P. Clarke 202,094
Cans, attachment for oil, J. H. Stump 202,300
Cap and collar combined, M. Isidor 202,262
Car coupling, J. Chapman 202,229
Car coupling, E. A. Howland 202,261
Car coupling, F. P. Iannarone 202,109
Car coupling, E. R. Quimby 202,117
Cars, unloading, Merrill & Dowling 202,182
Card, sample, A. Zerban 202,210
Carriage and chair, Tenney & Hobbs (r) 8,166
Carriage door, A. Bink 202,091
Carriage window, J. Woods, Jr 202,131
Cartridge, signal, E. W. Very (r) 8,167
Caster for trunks, M. Schwerin (r) 8,171
Centrifugal machine, B. T. Babbitt 202,135
Centrifugal machine, G. F. Eisenhardt 202,251
Chair, convertible, H. C. Hayman 202,170
Chair, rocking, C. S. E. & J. G. Spoerl 202,291
Chuck, M. C. Holmes 202,260
Cigar lighter, I. N. Clawson 202,150
Clock, H. W. Ley 202,275
Clock case, H. J. Davies 202,095
Cloth measuring and rolling, C. Q. Smith 202,288
Cock, cylinder, G. F. Hammer 202,167
Coin, holding and counting, J. Ostergard 202,188
Collar, W. Wilson (r) 8,169
Cooler, milk, W. H. White 202,129
Cotton gin feeder and cleaner, W. L. Crowson 202,238
Cotton lint room, fireproof, Z. N. Morrell 202,283
Cranberry gatherer, A. K. Gile 202,103
Crimping form, J. Ryan 202,123
Cultivator, F. C. Leffler 202,112
Cultivator, harrow, C. La Dow (r) 8,159
Currycomb, J. E. Finley 202,161
Ditching machine, G. E. Stewart 202,200
Drain trap, J. H. Shedd 202,287
Dredger, T. B. Carr 202,228
Drill and fertilizer, M. V. Dadisman 202,240
Dry closet, P. McMackin 202,278
Egg carrier, J. T. Fogg 202,253
Egg carrier and tester, C. H. Wyman 202,132
Egg carrier, fastening, N. C. Amsden 202,213
Elevator Johnston & Marshall 202,264
Elevator, ice, J. Macomb 202,181
Elevator, W. B. Doty 202,248
Elevator valve gear, C. W. Baldwin 202,215
Engine, reciprocating steam, T. A. Henderson 202,171
Engine, rotary, B. T. Babbitt 202,134
Engine, traction, G. Rogers (r) 8,164
Envelope, E. Ridge 202,194
Felting machine, G. B. Field 202,252
Fence post, S. N. Lennon 202,179
Fifth wheel for vehicles, M. Powe 202,190
Firearm, C. W. Sneider 202,126
Fire escape, J. P. R. James 202,263
Fire escape, C. R. Mott 202,115
Flooring, laying, C. Mudge 202,187
Fruit packing box, P. C. Burke 202,224
Fuel, compound, D. C. Breed 202,092
Furnace for pulverized ores, C. Stetefeldt (r) 8,165
Furnace, quicksilver, R. F. Knox 202,274
Furnace, heating attachment, S. N. Carvalho 202,148
Game apparatus, G. L. Witsil 202,313
Gas manufacture, Macy & Reed 202,279
Gate, flood, D. Bowles 202,321
Glass face protector, C. A. Kirtland 202,175
Governor, J. A. Rigby 202,121
Grading machine, W. L. Freese 202,163
Grain drying apparatus, H. G. Seeber 202,124
Grain meter, J. C. Hunt 202,172
Gun tool and whistle, A. E. Barthel 202,136
Hams, putting up boneless, T. Culver 202,239
Harrow and weed cutter, J. W. Fees 202,098
Harvester, H. Kelly 202,269
Hat, W. A. Bate 202,217
Herder, R. D. Soper 202,289
Hinge, T. Fowler 202,162
Hoisting mechanism, S. E. Stokes, Jr 202,298
Horse collar, Staufenbeil & Staehli 202,201
Horses from vehicles, detaching, W. A. Bryant 202,223
Hose nozzle, A. Weber 202,207
Hub, J. M. Whiting 202,208
Hub, C. T. Wecker 202,315
Hydrant, White & Kupferle 202,316
Ice machine, congealing plate, J. P. Jones 202,265
Indicator for ships, shoal, C. C. Miller 202,184
Jar, L. Clabaugh 202,093
Knife blade manufacture, S. M. Moore 202,282
Ladder, D. D. Hays 202,169
Lamp, G. H. Chinnock 202,234
Lamp, H. Craighead 202,236
Lamp shade, G. H. Chinnock 202,232
Lamp shade and base, G. H. Chinnock 202,233
Lavatory, A. J. Bell 202,139
Leaf turner, G. F. Spiess 202,290
Leather shaving and whitening, J. G. Buzzell 202,226
Lifting jack, B. M. Sherman 202,197
Lock bolt and handle, W. S. Montgomery 202,186
Lock, car seat, A. K. Waddill 202,308
Locomotive head light, C. Byrne 202,227
Locomotive exhaust, G. S. Brainerd 202,144
Locomotive variable exhaust, G. S. Brainerd 202,145
Lubricator, W. A. Clark 202,235
Mallet handle, G. B. Goddard 202,165
Mattress, invalid, C. B. Price 202,116
Meat mixing machine, O. E. Walker 202,206
Medical compound, H. Bowie 202,141
Medical compound, T. P. Childs 202,231
Medical compound, G. P. Delisser 202,246
Middlings separator, C. H. Sinderson 202,198
Mill pick, A. W. Straub 202,299
Millstones, lubricating bearings for, J. W. Batty 202,218
Napkin holder, L. Thompson 202,202
Nutlock, R. Dunn 202,249
Nut lock, W. Walter 202,310
Ordnance, loading attachment, D. D. Johnson 202,174
Ore separator, D. C. Roberts 202,122
Pan, dust, G. Macardale 202,277
Paper bag holder, S. L. Chapman 202,230
Paper, machine for, R. D. Mossman 202,185
Paper machine, B. F. Barker 202,216
Papermachine, W. A. Doane 202,097
Pencil sharpener, E. D. Miller 202,183
Piano action, electro-magnetic, M. Delaney 202,096
Plaiting machine, J. E. Wilson 202,211
Planter attachment, corn, W. F. Senter 202,196
Planter, B. F. Adams 202,133
Planter, G. I. Butler 202,147
Plow, E. Barber 202,090
Plow, A. W. Tucker 202,304
Press follower, baling, E. M. Ivens 202,110
Press, hydraulic, J. G. Steen 202,292
Psychrometer, N. M. Lowe 202,276
Pulley, friction clutch, J. B. Warner 202,312
Pump, W. S. Laney 202,178
Pump valve, A. W. White 202,128
Radiator, steam, J. R. Reed 202,192
Rails, pile for re-rolling old, L. Jones 202,266
Rake, horse hay, W. B. Jackson 202,173
Rein holder, G. & H. Piper 202,189
Revenue register, S. J. Tucker 202,305
Saccharine liquids, defecating, F. L. Stewart 202,295
Sand paper roll, Rathbun & Adams 202,119
Sandal, A. M. Woodhull 202,209
Sash fastener, O. R. Cooke 202,152, 202,154
Sash fastener, L. S. Gibson 202,254
Sash fastener, M. L. Kingsley 202,273
Sash, window, G. W. Dickinson 202,247
Saw mill head block, J. Cain (r) 8,162
Saw mill steam feed works, D. C. Prescott (r) 8,160
Saw sharpening machine, J. Wagner 202,309
Screen, coal and potato, W. Van Houten 202,306
Seal fastening, S. Keeler 202,267
Sewerage valve, W. L. Belt 202,219
Sewer trap, Dunn & Birdsall 202,250
Sewing machine needle, W. C. Cross 202,237
Sewing machine attachment, H. J. Watkins 202,313
Sewing machine presser foot, W. F. Trowbridge 202,303
Sewing machine wax thread, H. J. Watkins 202,314
Shell, percussion, J. M. Urquhart 202,203
Shoe shank machine, J. Hyslop, Jr. (r) 8,163
Shutter worker, P. C. Close 202,151
Sifter, ash, J. E. Cumings 202,157
Silk, regulator for reeling, E. W. Serrell, Jr 202,125
Skid, C. A. & J. A. Koehler 202,177
Skylight, M. T. Durkin 202,160
Spring, door, C. Ferchlandt 202,099
Square, adjustable centering, H. B. Little 202,180
Stench trap, T. G. Knight 202,176
Storehouse, J. E. Walsh 202,311
Stove, D. L. Stiles 202,297
Stove and furnace grate, W. B. Geddes 202,102
Stove, cooking, G. W. Walker 202,204, 202,205
Stove door and window, D. L. Stiles 202,296
Stump extractor, C. Haines 202,107
Switch, brace and plate, J. T. Richardson 202,286
Table, S. W. Steves 202,294
Target, J. Gobbels 202,255
Target thrower, ball, P. Taltavull 202,301
Thrashing machine, H. B. Stevens 202,293
Tire upsetter, J. W. Bodge 202,220
Tobacco, manufacture of plug, D. W. De Forest 202,245
Tongs, pipe, H. Badcock 202,089
Tool handle, P. A. Gladwin 202,105
Top, spinning, C. Raetz 202,118
Toy, flying, C. Mettam 202,281
Toy money box, J. W. Hoard (r) 8,170
Trace, wire rope harness, F. M. Collier 202,153
Tray machine, wooden, Brown & Kimball, Jr 202,146
Tuyere, J. F. Maguire 202,280
Type writing machine, Brady & Warner 202,143
Umbrella cases, eyeletting, W. Harnah 202,168
Umbrella holder, J. H. Bowers 202,140
Valve, air, E. A. Wood 202,130
Valve gear for engines, C. Brown 202,222
Valve motions, link for, S. Hamblin 202,166
Valve, stop, Worthen & Gillespie 202,319
Vehicle gear, J. J. Gallagher 202,164
Vehicle running gear, J. Bowman 202,142
Ventilator, car, C. A. Daniels 202,241
Wash bench and wringer, P. H. Cooney 202,155
Wash board, F. W. Parsons 202,285
Wash stand, H. S. Hale 202,257
Washing machine, Gladwell & White 202,104
Washing machine, J. R. Underwood 202,307
Washing machine, J. Will 202,317
Washing machine, D. J. H. Davies 202,243
Water meter, Stannard & Reynolds 202,127
Wave power mechanism, C. W. Lord 202,113
Weather strip, H. B. Alvord 202,088
Welding chain links, J. Haley 202,258
Wheel, T. Burnett 202,225
Wheel, T. H. King 202,271
Whiffletree attachment, R. W. Smalley 202,199
Window cleaner, W. C. Gayton 202,101
Wrench, C. W. Hilton 202,259

TRADE MARKS.

Adhesive materials, D. D. Comes 5,846
Baking powder, Smith, Hanway & Co 5,834
Chewing tobacco, J. W. & C. G. Holland, 5,851, 5,852, 5,854
Cigars, cigarettes, etc., Kerbs & Spiess 5,832
Cigars, cigarettes, etc., J. Blakely 5,830
Cigars, cigarettes, etc., E. Hilson 5,841
Essence of petroleum, Weeks & Potter 5,836
Flour, F. W. Brickey 5,845
Flour, G. V. Hecker & Co 5,828
Horseshoe nails, Ausable Horse Nail Company 5,829
Lead pencils, Eagle Pencil Company 5,850
Liniment, Clark & Co 5,847
Locks and keys, The Smith & Egge Mfg. Co 5,835
Medicines for catarrh, etc., Heintzelman & Coe 5,831
Pile ointment, Coussens & Tabler 5,848
Plug chewing tobacco, H. M. Cochran 5,838
Printing presses, J. W. Daughaday & Co 5,839
Spool cotton, C. T. Smith 5,844
Smoking, etc., tobacco, J. W. & C. G. Holland 5,853
Smoking tobacco, R. M. Chambers 5,837
Smoking tobacco, B. Leidersdorf & Co 5,842
Tonic, G. W. M. Reed 5,843
Tooth wash and powder, C. D. S. Fruh 5,849
Woolen or worsted yarns, J. C. Graham 5,840
Yeast, Richard & Wood 5,833

DESIGNS.

Breastpin, W. Britton 10,620
Font of printing types, G Giesecke 10,622
Font of printing types, A. Little 10,623
Ornamental chain, D. A. Beam 10,619
Pistol handles, Harrington & Richardson 10,621
Wall pockets, F. E Porter 10,624

For the Week ending April 16, 1878.

Advertising apparatus, E. Bostock 202,325
Amalgamator, Bancroft & Walker (r) 8,175
Amalgamator, W. S. Shotwell 202,595
Anchor, E. N. Twiss 202,488
Bale tie, J. Knipscheer 202,552
Bale tie hook machine, P. L. Van Derzee 202,491
Batting, machine for folding, H. A. Stearns 202,480
Bedstead, invalid, M. Gillespie 202,343
Beehive, D. P. Miller 202,569
Bee hive, A. E. Wenzel 202,612
Billiard cushion, J. E. Boyle (r) 8,172
Bit stock, W. A. Ives 202,548
Boiler, steam, L. Shook 202,382
Boilers, bolt for patching, F. A. Bidwell 202,403
Boilers, supplying feed water to, S. M. Fulton 202,535
Boot and shoe counter support, B. W. Campbell 202,409
Boot and shoe stiffeners, W. N. Sprague (r) 8,184
Boot upper, Allen & Cook 202,393
Boot and shoe channeling tool, C. K. Sharood 202,478
Boot and shoe manufacture, L. E. De Waru (r) 8,182
Bosom form, J. D. Banfield 202,398
Bottle stopper, W. D. Doremus 202,525
Bottle stopper, G. W. Gomber 202,434
Brake, car, A. Rosenfield 202,472
Brake lever, wagon, T. C. Lawrence 202,557
Brakes, coupling for air, G. H. Newton 202,368
Brick kiln, J. Haas 202,542
Brick kiln, S. W. Underhill 202,489
Brick machine, W. T. Duvall 202,336
Brick machine, E. R. & W. E. Gard 202,537
Bridge, truss, W. O. Douglas 202,526
Bridle safety attachment, T. E. Clark 202,522

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Brush for cleaning boiler flues, C. C. Miller	202,361
Burglar alarm, A. L. Linn	202,447
Burial casket, J. Homrighous	202,440
Butter worker, F. G. Butler	202,516
Butter worker, W. Sweet	202,481
Button, S. Cottle	202,412
Button hole cutter, F. C. Leypoldt	202,446
Button polishing machine, W. F. Niles	202,369
Can, metallic, G. H. & J. H. Perkins	202,371
Can, sheet metal, M. Brenner	202,514
Can, transportation oil, N. Du Brul	202,335
Candle holder, F. Galster	202,342
Canvas stretcher, E. H. Collins	202,330
Car coupling, L. M. Dice	202,333
Car coupling, J. A. Woodmansee	202,622
Carpet lining, C. A. Pease	202,579
Carriage and chair, T. & T. P. Longking	202,560
Carriage seat, J. D. Olds	202,575
Carriage top adjuster, C. Dudley	202,527
Carriage top adjuster, P. H. Lindsey	202,355
Carriage top adjuster, A. Clarke	202,329
Cartridge, R. Morris	202,365
Cartridge holder, Pooler & Jones	202,463
Cartridge shells, manufacture of, T. B. Moore	202,363
Caster frame, G.B. Jenkinson (r)	8,180
Ceiling, fireproof, P. B. Wight	202,617
Cellar grating, D. B. Shirk	202,381
Celluloid coating, J. W. Hyatt	202,441
Chain, sheet metal, F. Egge	202,528
Chair, J. Ask	202,505
Chair, convertible, C. Burnitz	202,327
Chair, oscillating, R. Otto	202,576
Chair, rocking, M. Schrenkeisen	202,476
Chandelier, oil, F. Rhind	202,585
Check, blank, F. W. Brooks	202,515
Chicken mother, artificial, J. Rabenberg	202,466
Churn, S. Kreiter	202,554
Cigar cutter, L. H. Lipman	202,559
Clay pulverizing machine, W. T. Duvall	202,337
Clog, rubber, J. Pienovi	202,462
Cocoa nut, desiccating, S. T. Chase	202,521
Coffin, J. Richey	202,470
Coffin Handle, P. A. Mowers	202,367
Coffins, apparatus for lowering, J. W. McCaslin	202,359
Coin holding device, G. S. Ball	202,507
Coin holding device, F. H. Holmes	202,545
Cooler, F. W. Wiesebrock	202,389
Cordage, machine for making, G. L. Brownell	202,406
Corn stalks, machine for cutting up, J. Forlow	202,531
Cotton gin, Brackett & Merrill	202,326
Cotton gin condenser, O. Washburne	202,611
Cultivator, G. W. Staver	202,383
Curry comb, M. Cole	202,410
Curry comb, L. A. Griswold	202,436
Curry comb, M. Sweet	202,482
Curtain roller and bracket, A. B. Shaw	202,592
Curtain stretcher, J. Conrath	202,411
Dash rail, J. F. Fowler	202,532
Dental engine, S. S. White	202,497
Dish, butter, G. E. Savage (r)	8,179
Distance and velocity recorder, G. Gobel	202,433
Ditcher and cultivator, O. T. Davies	202,416
Door hanger, H. E. Richards	202,587
Doubling and twisting machine, T. Kershaw	202,550
Draught equalizer, L. W. Frederick	202,432
Draught equalizer, W. A. Laird	202,555
Drill, rock, W. H. Elliot	202,338
Drilling machine, coal, J. Price	202,372
Drilling, platform for submarine, T. Cumming	202,415
Effervescent liquid apparatus, A. Habernicht	202,543
Elevatorand unloader, hay, A. H. McKitrick	202,450
Elevator, wet grain, G. Bartholomae	202,401
Elevators, safety check for, J. Marshall	202,561
Engine, knapsack fire, J. W. Douglas (r)	8,177
Engine, traction, M. Fortin	202,429
Engines, superheated steam, Seilliere & Riot	202,591
Fence, M. S. Zimmerman	202,503
Fence post, H. H. Sherwood	202,594
Fence, water bed, F. Feike	202,428
Fence, water bed, J. B. Mynatt	202,572
Fences, metal post for wire, C. N. Rand	202,468
Fertilizer, G. J. Popplein (r)	8,187
Filter, R. S. Jennings (r)	8,183
Filter, E. T. Rogers	202,471
Finger ring, W. Riker	202,588
Firearm, W. H. Baker	202,397
Firearm, B. F. Joslyn	202,350, 202,351
Firearm, A. T. De Mouncie	202,418
Firearm, D. B. Wesson	202,388
Fire escape, J. J. Adgate	202,504
Fire escape, G. Martin	202,562
Fire escape. W. C. Phillips	202,460
Fire place, S. W. Dixon	202,419
Fluting machine, T. Robjohn (r)	8,174
Fodder cutter, G. Knoth	202,553
Food for animals, preparing, J. McKee	202,360
Forge, portable, G. B. Phillips	202,461
Friction clutch, H. Barnes	202,400
Furnace, cupola, D. Thomas	202,605
Furnace grate, J. Ashcroft	202,323
Furnace, heating, H. Holcomb	202,439
Furnace, locomotive boiler, F. Reimherr	202,375
Furnace, metal heating, J. McCrea	202,566
Gas lighter, J. R. Scattergood (r)	8,173
Gas manufacture, G. Ramsdell	202,374
Gate, E. W. Beebe	202,508
Gate, D. Edgar	202,422
Gate, Williams & Hubbell	202,620
Gate, farm, J. H. Buscher	202,328
Gems, setting for, W. A. Bates	202,402
Glass, tempering, G. E. Hatch	202,544
Glassware, reheating furnace for, W. Fox	202,533
Governor, H. W. Foutz	202,430
Governor, W. H. Craig	202,332
Guns, rubber butt plate for, Thornton & Beam	202,606
Hame, A. P. Rose	202,376
Harness pad, L. W. Vandenburg	202,490
Harvester cutter bar, M. G. Bell	202,510
Hat pouncingmachine, R. Eickemeyer	202,529
Hay rack, J. B. Hoffman	202,347
Heel trimming machine, A. K. Washburn	202,494
Hoe and brier hook, C. A. Masterson	202,563
Hog cholera compound, J. H. Rees	202,583
Hold-back for double harness, J. E. Reeves	202,584
Horse collar, J. B. Ingalls & R. Clark	202,348
Horse collar, S. Taylor	202,604
Horseshoe nail manufacture, C. French	202,534
Hose coupling, A. Work	202,392
Hose manufacture, H. J. Merrens	202,451
Hydraulic power accumulator, W. D. Grimshaw	202,435
Incubator, J. Rabenberg	202,467
Insole, M. Silverberg	202,596
Iron, chilling, S. A. Ford	202,530
Ironing table, E. A. Hill	202,438
Irrigation, J. A. Conway	202,331
Jewelers' dies, G. Sisson	202,597
Key, P. A. Oliver	202,457
Knife, hay, H. O. Turner	202,487
Knitting machine cam, W. J. McDevitt	202,567
Lacing hook, E. Maynz	202,564
Ladder, extension, G. M. Evans	202,426
Ladder, fire escape, J. P. Morris	202,364
Ladles for molten metal, Aiken & Drummond	202,321
Lamp burner, R. B. Perkins	202,580
Lamp wick, O. Mayo	202,358
Latch, M. C. & S. S. Niles	202,573
Latch, R. B. Ruggles	202,474
Latch, door, S. Black	202,404
Leather impervious to gas,rendering, E.Osgood (r)	8,186
Letter sheet, L. H. Rogers	202,589
Letter sheet and envelope, W. R. Ross	202,377
Lifting jack, S. Lesher	202,354
Lightning rods, making, T. H. Patee	202,578
Lock, G. E. Bendix	202,511
Lock, spindle and fastening, M. C. & S. S. Niles	202,574
Loom harness, T. A. Emmons	202,339
Meat chopper, M. J. Stein	202,600
Mirror, H. S. Wood	202,621
Miter machine, G. Lennartson	202,445
Moulder's flask, C. H. Porter	202,464
Moulding machine, Aiken & Drummond	202,322
Nail plate feeding mechanism, C. Ellis	202,425
Netting machine, H. W. Thurston	202,386
Nut lock, S. Brunson	202,407
Nut lock, H. C. Stouffer	202,603
Paddlewheel, feathering, T. Cullen	202,523
Pan, dust, E. E. Mann	202,357
Paper box machine, W. J. Keefe	202,352
Paper, ornamental, W. E. Syms	202,483
Paper pulp, making pails from, M. E. Hubbard	202,547
Paper pulp, finishing hollow articles, W. J. Keefe	202,353
Pen, W. M. Prince	202,465
Piano, G. Caddick	202,408
Pianoforte action, A. H. Hastings (r)	8,185
Pillow sham, C. A. Weed	202,387
Pipe coupling, S. P. M. Tasker	202,384
Plaiting machine, J. Hochheimer	202,346
Planter, hand corn, J. Shew	202,593
Plow, Glidden & Vaughan	202,538
Plow, Jerauld & Stolle	202,349
Plow, Whittlesey & Noble	202,615
Pocketbook, coin, A. L. Thurston	202,486
Propeller blades, reversing, C. M. Bailey	202,396
Pruning shears, J. W. Weymouth	202,496
Pruning shears, J. Wilz	202,499
Pump, H. Berg	202,512
Pump, J. W. Palmer	202,577
Pump, oil, McCarthy & Giles	202,565
Railing, W. H. Brines	202,405
Railway frog, L. Murphy	202,455
Railway track, T. W. Travis	202,607
Raw hides, boarding, W. Coupe	202,414
Razor strop, J. Lamont (r)	8,181
Reamer, F. W. Wild	202,618
Refrigerating apparatus, Bell & Coleman	202,509
Retorts, etc., making, W. Morgan	202,366
Revolver, magazine and holster, R. White	202,613
Roof, gravel, E. B. Warren	202,493
Saddle bag, A. L. Hernstein	202,345
Sash balance, W. K. Azbill	202,324
Sash cord guide, T. Van Wagoner	202,492
Sash holder, J. F. Severance	202,380
Saw, J. R. Woodrough	202,500
Scraper, sulky, S. S. Terwilleger	202,484
Scraper, sulky road, N. D. Edmondson	202,423
Scraping tool, L. F. A. Legouge	202,444
Screen, window, W. D. Stevens	202,599
Screw threads, cutting, M. Minahan	202,362
Seeding machine, J. C. Mundel	202,571
Sewer cleaning device, E. M. Chapin	202,519
Sewer man-hole plate, D. W. Purtell	202,373
Sewing machine, G. Hancock (r)	8,178
Sewing machine shuttle, N. D. Stoops	202,602
Sewing machine ruffler, J. A. Davis (r)	8,176
Shaft coupling, C. G. Rowell	202,473
Shaftjournal and box therefor, W. H. Atkinson	202,395
Sheep shear thumb rest, J. Richardson, Jr	202,469
Sheep skin, artificial, C. A. Evans	202,427
Sheet metal vessels,handle for, F.Grosjean 202,540,	202,541
Shirt scales, Spreecher & Keller	202,479
Shirt manufacture, W. D. Lawton	202,558
Shovel, T. B. De Forest	202,524
Shutter worker, T. Corrigan	202,413
Silk, etc., spindle for cleaning, E. J. Martin	202,448
Smoke and conveyer for trains, J. Casey	202,518
Soda, bicarbonate of, Lewis & Menzies	202,356
Spark arrester, A. Elliott	202,424
Spike extractor, W. Upton	202,609
Spinning frame, thread guard support, J. Doyle	202,420
Spooling machine, T. Kershaw	202,549
Spoons, making sheet metal, M. Fowler	202,431
Spring, carriage, J. Enders	202,340
Spring, vehicle, J. Batt	202,506
Spring, vehicle, J. Enders	202,341
Spring, vehicle, W. W. Wills	202,390
Sprinkler, W. S. Doughty	202,334
Sprinkler, clothes, D. Whittaker	202,616
Steam trap, J. L. Chapman	202,520
Steel, utilizing scrap, T. M. Carnegie	202,517
Stem winder, crown push, J. J. Peux	202,459
Stocking drier and stretcher, P. W. Whitcomb	202,498
Stocking supporter, F. Armstrong	202,394
Stove grate, McClare & Price	202,449
Stove pipe joint lock, J. W. Woolsey	202,501
Sulphur from its ores, separating, R. G. Leckie	202,443
Tape measure, A. F. Ward	202,610
Telegraph, electro-harmonic, Gower & Matthews	202,539
Teleg aph, underground, J. B. Hyde	202,442
Telegraph wire coupling, A. R. Lane	202,556
Telephone call signal apparatus, T. A. Watson	202,495
Tellurian, J. Schedler	202,590
Thrashers, band cutting feeder, M. M. Hooton	202,546
Tile machine, M. Moore	202,454
Tobacco cutting machine, J. F. Tygh	202,608
Tobacco plants, setting, F. M. Meyer	202,452
Tobacco washer, H. Messmer	202,568
Torpedo boat, H. Mortensen	202,453
Trace carrier, M. E. Zeller	202,502
Traveling bag frame, M. C. Schutz	202,379
Umbrella holder for vehicles, E. Thomas	202,385
Vessels, gaff for, T. C. Thompson	202,485
Washboard, G. Gallup	202,536
Washing machine, J. Dunn	202,421
Washing machine, J. G. Oesterle	202,456
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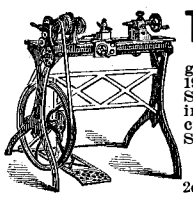

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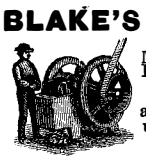

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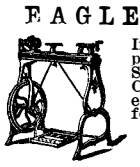

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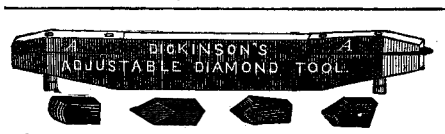

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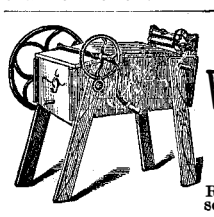

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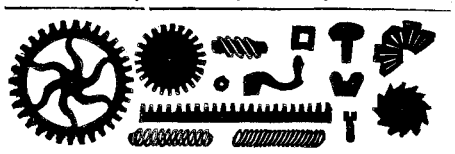

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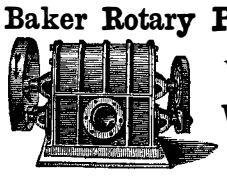

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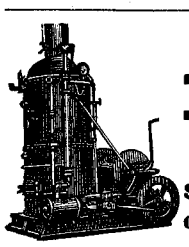

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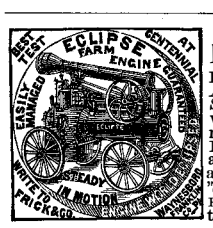

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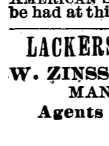

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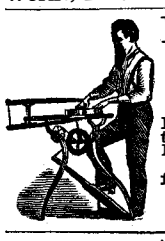

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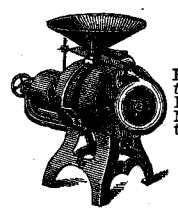

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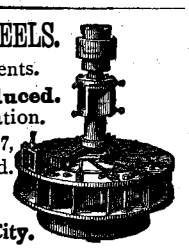

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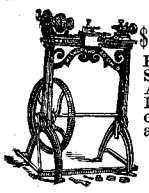

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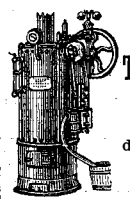

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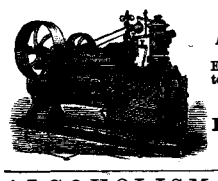

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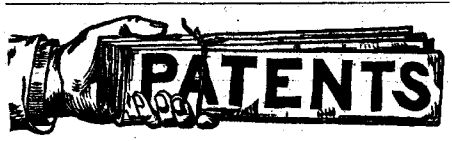

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